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UNIVERSAL EXPOSITION, SAINT LOUIS, 1904.

FORESTRY
AND
FOREST-PRODUCTS
OF
JAPAN.



TOKYO.

Bureau of Forestry, Department of Agriculture
and Commerce.

(1904).

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CORRECTIONS.

On account of the difficulties not only of writing, but of printing, in a foreign language we regret to say that various errors will be found in the following pages, especially at the beginning of the book. The most important errors are given below. (The number of the line counted from the bottom is marked thus —4).

Page	Line	For	Read	Page	Line	For	Read
1	7	rested	vested	58	13	94,492.966	94,492.906
2	6	1,323	1,259	58	14	35,650.657	35,436.657
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4	22	<i>delete</i>	and	58	18	94,492.966	94,492.906
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5	9	Prive	Private	59	2	51,292,019	51,291,959
9	—12	most	mostly	59	4	51,292,019	51,291,959
14	6	Ulnus	Ulnus	66	—12	Group	Class
14	12	Petula	Betula	74	8	Yakushinia	Yakushima
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23	—15	Marus	Morus	95	1	Group	Class
29	— 6	Group	Class	96	15	sublimating	fractional dis-
32	9	331,08	311,08				tillation of
32	10	Future	Forest	96	18	fuses	boils
37	3	<i>delete</i>	par	96	—12	fuses	boils
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37	— 2	0.30	3.00			suitable	{ ion to strong
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39	14	<i>delete from</i>	as to year	102	— 9	Gemula	tremula
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FORESTRY AND FOREST PRODUCTS IN JAPAN.

FOREST ADMINISTRATION IN JAPAN.

Japan, being a constitutional monarchy, the authority rests with the Emperor. He exercises the legislative right with the approval of the Parliament, justice is administered through tribunals in his name, and the executive power is rested in the Cabinet.

The government consists of the Departments of Home Affairs, Foreign Affairs, Finance, War, Navy, Justice, Education, Agriculture and Commerce, and Communications. The Cabinet is composed of the Ministers of the State for the above Departments. They consult about important State Affairs, and direct the respective Department over which they preside.

The law is well observed throughout the Empire, the people are generally well educated, and perfect autonomy in its highest form is enjoyed.

The Forest Administration of the Empire is regulated by the "Forest Law" of 1897, which provides the rules regarding the working of the "Available Forests," as well as for the restriction of felling in the "Reserve Forests" with other matters connected therewith.

The execution of the same law is carried on by the local government, being, at the same time placed under the Surveillance of the Minister of Agriculture and Commerce.

The administration of State Forests is regulated by the "Law of State Forests and Unused Land" of 1899, and the official

organization was established by the promulgation of an Imperial Ordinance in 1886. By virtue of this ordinance, the whole Empire was, as it is, divided into ten districts as they are termed "Major Forest Reserves," which are again subdivided into smaller districts termed "Minor Forest Reserves" numbering 270 in all. The latter, in turn, are again subdivided into 1,323 smaller "Protective Ranges." The locations of the Major Forest Reserves, their jurisdictions, as well as the number of lower divisions are shown in the following table :

Major Forest Reserve.	Location of Major Forest Reserve.	Extent of jurisdiction of the M. F. R.	Number of Minor Forest Reserves.	Number of Protective Ranges.
		in 1,000 cho.		
Aomori Dai Rinkusho...	Aomori, Mutsu	1.370	35	173
Akita „ „ ...	Akita, Ugo	1.091	21	95
Miyaghi „ „ ...	Sendai, Rikuzen.....	1.286	34	150
Tokyo „ „ ...	Tokyo, Musashi	936	23	89
Nagano „ „ ...	Nagano, Shinano	931	14	64
Osaka „ „ ...	Osaka, Settsu	567	20	98
Hiroshima „ „ ...	Hiroshima, Aki	281	32	169
Kochi „ „ ...	Kochi, Tosa.....	336	27	122
Kumamoto „ „ ...	Kumamoto, Higo	331	40	158
Kagoshima „ „ ...	Kagoshima, Satsuma	446	24	141
Total	10 Major Reserves.	7.575	270	1.259

The above organic law is now in force in the Mainland, Shikoku and Kiushiu. The State Forests of Hokkaido, owing to the advancement of colonization in that island, are now placed under the direction of the Department of Home Affairs, the direct charge of which, however, is vested in the Governor of the same island. The State Forests of Formosa, too, form another special case to be directly managed by the Governor there, under surveillance of the Minister of Home Affairs.

FORESTS IN JAPAN.

Geographically, Japan is composed of six principal islands and smaller ones of varied size and importance, numbering several hundreds.

As the country is very mountainous, the land available for cultivation is comparatively limited, leaving most of the land covered with trees and shrubs. In all 23,087,000. "*cho*," or 59 % of the total area of Japan is occupied by forests.

From an economic point of view Forests in Japan are divided into two categories ;—

" Reserve Forests and Available Forests."

The object of the former is the preservation of forest-trees, by preventing reckless felling, which often impoverishes the fertility of surrounding districts, thereby causing the economic perils as well as the welfare of the country. The object of the latter is to produce the largest possible yield by encouraging the free exertions of enterprising foresters to form a valuable source of wealth for the country.

The following figures give the areas of these two classes of forests.

Reserve Forests.....	699.148 " <i>cho</i> "
Available Forests.....	22.388.216 " <i>cho</i> "
Total.....	23.087.364 " <i>cho</i> "

As might be expected, difference in the ownerships of these forests, causes dissimilarity in the mode of working and management which influences the economic value of the forests. In general, those forests which form a part of State or Crown property being improved in accordance with the results of modern scientific research. These forests are valuable while most of the forests held privately are left in their natural condition with no attempt of improvement.

It is, of interest to classify forests according their ownership.

State	Forests	13.125.320 " <i>cho</i> "
Crown	"	2.091.789 "
Municipal	"	1.714.754 "
Forests of Shrines and Temples }		167.629 "

Private Forests 5.987.872 "cho"

Total..... 23.087.364 "cho"

Besides these, there are large unused areas of land in Japan termed "unused land" "Genya". This term, in its modern sense, is none other than that given in our Cadastre which was formed soon after the Restoration. Practically "Genya" is uncultivated land, devoid of trees and in most cases of water, which latter quality is the most important factor for the conversion of the land into paddy fields. As to the locality and nature, "Genya" bears a close relation to the forests. It is hoped that a part of this unused land may be profitably utilized either for grazing or for cultivation, nevertheless there is strong reason to believe that most of the "Unused Land" as it is termed, will finally be converted into forests. Indeed, this class of land is important on account of its extent both in the Mainland, and in Hokkaido. Some parts of it give promise of affecting the supply of timber in the future.

The unused land (Genya) under State ownership was, in 1901, 1,434,666. "cho" that held by the Crown was 157,174 "cho," while the remaining 1,053,462 "cho" was private property. The total area was 2,645,302 "cho" or 6,8 percent of the whole area.

Forests are found everywhere in the Empire from Formosa in the extreme South and to Hokkaido in the extreme north. This distribution, is however greatly influenced by the diversity of climate, and the density of population, as well as by social conditions. Excepting a few forests scattered over the plains, the main forest land is in corresponds to the mountain system of the country which traverse the whole Empire lengthwise from the south to the north. Thus, the different mountain chains which traverse Hokkaido lengthwise and crosswise, constitute a splendid forest area. In the Main Island a chain of forests begins with Hakkoda in Mutsu, and extends to the boundary line between Shinano and Echigo, whence it goes on to form the Kiso forests. Then, bending southward, it runs in an unbroken line from Mt. Asama in Shinano to the Crown Forests of Fuji and Amagi between the provinces of Kai and Suruga. In the province of Kii, the chain starts from Mt. Kumano whence it runs to meet the forests in the Yoshino district of Yamato. In Shikoku the line crosses the boundary between Sanuki and Awa

and proceeds over the summit of Mt. Ishizuchi to the forests in Tosa. In Kyushu, the line is continued through Mt. Aso and stretches to Mt. Kirishima towards the south. Thus the forests of Japan mostly lie in the mountainous districts along the backbone of the country and are seldom found in the plains or along the coast. Again, they are more numerous in the cold regions, in the north and considerably less in the warmer regions in the south, as shown in the following table :—

Regions	State Forests	Crown Forests	Municipal Forests	Forests of Shrines & Temples.	Private Forests	Total
	<i>cho</i>	<i>cho</i>	<i>cho</i>	<i>cho</i>	<i>cho</i>	<i>cho</i>
Hokkaido	5,492,489	651,550	—	—	14,827	6,158,966
Aomori	1,370,887	29,788	81,061	10,737	440,275	1,932,758
Akita	1,091,491	—	11,509	266	59,837	1,163,103
Miyagi	1,216,118	126	91,536	9,524	359,532	1,746,836
Tokyo	942,253	628,859	131,910	14,684	1,038,921	2,756,627
Nagano	931,746	476,304	275,214	2,328	305,735	1,991,327
Osaka	567,716	304,549	592,497	106,977	1,234,940	2,806,679
Hiroshima	281,948	513	344,763	12,829	1,342,579	1,962,632
Kochi	336,312	—	87,965	4,526	597,274	1,206,079
Kumamoto	331,442	—	45,718	4,546	503,124	884,830
Kagoshima	446,278	—	47,015	1,212	85,975	580,480
Okinawa	46,630	—	5,566	—	4,853	57,049
Total	13,125,320	2,091,789	1,714,754	167,629	5,987,872	23,087,364

1 *cho* = 2½ acres. 259 *cho* = 1 square mile.

The above table does not include the forests in Formosa and the Kurile Islands which are now under investigation.

The area of the State Forests is based on the statistics furnished by the Department of Agriculture and Commerce, that of Crown Forests on those furnished by the Imperial Household Department, while those of Municipal, shrines and temples and private forests, are based on the official returns of the respective local authorities.

As shown in the above table, the distribution of forests is indeed largely due to local influences, and the products are in like manner

very varied. Excepting Hokkaido, which was opened only 30 years ago, Japan, contains in the northern part, many mountains of great height and steepness. There, forest-trees grow most luxuriantly, and are the most valuable product of the land. In the middle part of the Main Island the mountains character is well represented by Mt. Fuji and the surrounding mountains. They decrease in height and number toward the South-West, where there is much well-worked arable land varied with some hills and mountains of less prominence. The unequal distribution of forests in this country is explained by these geological features combined with social and economic agencies which modify greatly the progress of this important national industry. In Shikoku, Kyūshū, and the western portion of Honshū, which are the oldest parts of Japan, the people have had better means of transportation than in other parts of the Empire, and owing to the growing demand for timber on account of the increase of population, the forests have been rather recklessly felled. This together with the greater need than in other regions for agricultural land must have led to the present scarcity of forest land in these parts. To examine the matter more closely, let us study the area of forest land in proportion to the population. Hokkaido, where the population is smaller than in any other part of the Empire has by far the greatest share of forests in proportion to the population, the rate being 6 *cho* for each. In Aomori and Akita, the rate is 1.5 *cho*; in Kochi, 0.4 *cho*, in Hiroshima and Kagoshima, 0.8 *cho*; and only 0.2 *cho* in Kumamoto which has the smallest proportion of forestland. The distribution is, therefore, far from being even and desirable.

In districts having a dense population there are more private and municipal forests, especially the former, as compared with State forests than in districts thinly populated. In the Southern provinces of the Main Island, viz in Osaka and Hiroshima the ratio of private forests to State forests is 5 to 1; in Shikoku this ratio is 2 to 1, while in parts Kyūshū, such as Kumamoto and Kagoshima, the two classes of forests are of nearly equal extent. On the contrary, in the northern provinces of the Mainland, the area of private forests is only one half of that of the State forests. In localities abounding in private forests, the State forests are all situated in remote mountain districts, the forests near market towns which have facilities for the transportation

of timber being owned mostly by private individuals. In proportion as the demand increases the proprietors are stimulated and more attention is paid to the cultivation and production of timber.

Summing up what has been said above, we do not hesitate to say that many of regions are still well provided with timber. More especially the northern provinces of the Main Island and Hokkaido are yet rich in forests both as regards area and producing capacity, a great proportion of the forest area being still unavailable for other uses. In these parts we find forests in the neighborhood of towns and villages, the produce of which being more than sufficient to meet the local needs for building, industrial, and mining purposes, is exported to other places in large quantities. Hokkaido exports timber to the Main Island and to China and Korea for use in building and in railway construction. *Thuja plicata* and *Cryptomeria japonica* (species of cedar) timber produced in Aomori and Akita are exported not only to Tokyo and Osaka but to Shikoku and Kyūshū. It may be interesting to note that, while in the northern provinces of the Main Island, we have chiefly virgin forests producing valuable timber. Among these virgin forests are the splendid forests in Kiso, Akita, and Aomori; the Kurobe State forest in Etchu; the private forests in the Tone districts in Josu, in Hayaike Mine in Rikuchū, and in the Chichibu districts in Musashi; as well as Mount Guntaku in Rikuzen and Mount Asama and Yatsugatake in Shinano.

There are, however, some planted forests along the River Tenryū in Enshū; and in the Tama and Chichibu districts in Musashi.

On the other hand the forests in the Southern provinces of the Main Island, in Kyushu and in Shikoku are mostly artificial forests, although there are some splendid virgin forests in Tosa and Osumi.

Sylviculture was early developed in Yoshino, Yamato; and in parts of Kii, Tamba, Inaba, Higo and Settsu, where we now find splendid woods producing both timber and fuel and managed under a scientific system.

The owners of these forests have already lately come to consider it to their advantage to cut their trees earlier than in former times leaving the production of big timber for special purposes to the natural forests in the north. The wide diffusion of the knowledge

of practical forestry among foresters, is inducing them to increase their products by the adoption of the more rational intensive system of modern days.

FOREST ZONES AND THEIR PRINCIPAL PRODUCTS.

The Japanese Empire is, as we have already pointed out, comparatively narrow from east to west and elongated from north to south extending from $21^{\circ}40'$ to $50^{\circ}56'$ north latitude. Its climate is subjected to very complex variations by the dry winds coming from the continent over the Sea of Japan on the west and by the presence of the moisture carried from the Pacific Ocean upon the South-East. The main body of the country was formed by volcanoes and presents a very irregular surface, the greatest elevations being as high as 11,500. ft. Climatic conditions are therefore very different in different parts of the country, but no place in it, except a portion of the Kurile Islands and a few high mountains, is found unfit for the growth of forest trees. We have all species of such trees growing in Japan from those belonging to the Torrid Zone to those of the Frigid zone. Thus Japan, has as rich an arboreal flora as any country in the world. In general, the temperature is milder than that of the actual latitude, due to the peculiar conformation of the land and water, the annual average temperature in Formosa being 23° C and that of Kamikawa in Hokkaido, 5° . Taking the averages of the seven months from April to October (months, having so to speak the greatest influence on the growth of forest trees) we find that Kyushu has an average temperature of $21^{\circ}.2$; Shikoku, $20^{\circ}.9$; the southern provinces of the Mainland, $20^{\circ}.4$; the northern provinces $18^{\circ}.4$; and Hokkaido $12^{\circ}.7$. The annual average is seldom found even in the high mountain districts to fall below 10° C. In comparing these with Dové's recognized standard temperatures it is found that they are higher by 1° for the Summer month and 7° lower for the winter months. In the course of the year the temperature falls lowest in the month of February and rises highest in August gaining 4° per month on the average. In August

the downward course begins and is continued until February. It is observed that the period during which the temperature rises is long and that it falls by sudden jumps during a short period conditions favourable to the growth of forest trees as is proved by the rapidity with which they actually grow in Japan. But it is to be remarked that the sudden changes that occur in some places are often found to be detrimental to young trees (by causing either early or late frosts.)

Japan, being surrounded on all sides by the sea, has warm ocean currents running near her shores and a range of mountains running from North to South which intercepts the moisture from the Sea and causes it to be condensed. Hence the rainfall in Japan is very great, being never less than 23.85 inches and sometimes as much as 119.25 inches in a year. The number of rainy days in the year sometimes exceeds 160. The half of the country facing the Sea of Japan is visited in the Winter by winds that have passed over the warm currents, and that half has in consequence an abundance of rain and snow ; while in the half looking toward the Pacific there is a heavy rainfall in Summer and Autumn owing to the moist southerly winds. As a rule, the amount of moisture in the air is never less than 60%, the annual average being 80%. This abundance of moisture, of rain and of snow, is extremely favourable to the growth of plants and consequently tend to the production of a luxuriant flora.

The land occupied by the sylvan flora of Japan has rocks belonging to almost all geological groups from the Archæan to the Cainozoic. They are different in different places and very complex in structure.

The forests in Hokkaidō most stand on new volcanic and sedimentary rocks, such as sandstone tuff and conglomerate belonging to the Tertiary system, and in a limited area upon Palæozoic rocks. The forests in the Akita and Aomori prefectures in North Japan, are found upon igneous rocks of the Tertiary system. In Central Japan, the mountain ranges facing the Pacific Ocean, geologically belong to the Archæan and Palæozoic groups. The forests in the Western portion of Honshu, especially Chugoku, stand upon the granite, while those in the provinces of Tamba and Tajima are found upon rocks of the Palæozoic group. The mountains of Shikoku like those of Yoshino in Yamato are composed of Palæozoic and Archæan rocks. In Kyushu only the southern section belongs

to the Palæozoic group, the greater part being mostly composed of igneous rocks. The country is fundamentally composed of Archean rocks with other strata upon them which are ejectamenta from volcanoes in the different periods of geological changes. These occasional additions of igneous rocks have been so large that at present nearly one-third of the forest land in the whole country is composed of such rocks. The principal igneous rock belonging to the Archean period is granite, and those that were ejected in the Palæozoic and Mesozoic periods are granite, porphyry, diorite, porphyrite. Of the ejected Rocks belonging to Tertiary, and Quaternary periods there is a large variety, but those covering the largest areas are andesite and basalt.

It is a notable fact that among the extensive forests of coniferous trees that have continued to maintain a fine appearance from ancient times, those depending on natural regeneration are mostly found upon igneous rocks, while the majority of those obtained by artificial regeneration stand on sedimentary formations.

The fact that the geographical and climatic conditions of the country vary in different places, as stated above, is favourable to the growth of various kinds of forest trees and the fact that the topographical and geological features of the country are also quite different in different places has caused a variety of forest growth to spring up. As it is, no less than eight hundred species and varieties of forest trees are found to be well suited for culture here. In practice, however, from an economic point of view forest management does not attach any special importance to over twenty species of forest trees.

The forests of Japan as shown in the Chart of Japanese Forest Flora are divided into four zones, viz: Tropical Forest Zone, Sub-tropical Forest Zone, Temperate Forest Zone and Frigid Forest Zone.

I. THE TROPICAL FOREST ZONE:—Extends over the whole of Formosa, the Southern half of the Loochoo Islands, the Yayeyama Group, and the Ogasawara Islands. From the standpoint of altitude these forests are found on Mt. Niitaka in Formosa up to a height of 1,500 ft. where the annual temperature does not fall below 21°C.

Of the Flora of Tropical Forest Zone, the Banyan heads the list, being followed in importance by *Pandanus odoratissimus*, L.,

Nephellium longana, Camb, *Areca catechu*. *L. Arenga saccharifera*, Labill, *Musa Basjoo*, Sieb, and bamboos. They are found in great luxuriance, especially the Banyan which alone comprises 18 distinct species. This tree stretches out its branches forming by itself splendid forests, as seen everywhere in the Island.

II. THE SUB-TROPICAL FOREST ZONE :—Comprises a portion of the Loochoo Islands, the whole of Shikoku and Kyushu and the part of the Main Island lying south of 36°. With reference to altitude places 6,000 ft. above the sea level in Formosa, below 2,800 ft. in Kyushu, and below 1,500 ft. on Mt. Tsukuba in the province of Hitachi, in the Main Island ; having an average annual temperature of 13°-21°C., belong to this zone.

The Sub-tropical Forest Zone is very rich of species, some of them having a high value in forest economy.

Thus, *Cinnamomum Camphora*, Nees., *Machilus Thunbergii*, S. et Z., *Buxus japonica*, Muell., *Quercus Phyllireoides*. A. Gr., *Quercus gilva*, Bl., *Quercus vibrayeana*. Fr. et Sav. *Quercus Acuta*, Thunb., among evergreen broad-leaved trees, are the predominating species in Kyushu, Shikoku, and the Southern part of the Main Island. They grow either in forests alone or sometimes mixed with other trees. The region occupied by evergreen broad-leaved trees produces extensively hard wood of various kinds, used in ship-building, furniture manufacture, and decorative work as well as in building and the manufacture of various implements, frames, doors, &c. &c.

Broad-leaved deciduous trees are not lacking in this zone of which two species worthy of special mention here are *Quercus serrata* Bl. and *Quercus ulticæfolia* Bl.

They are mostly grown artificially to form coppices and furnish the material for firewood and charcoal. Mushrooms termed "Shiitake" (smelling mushroom) are also grown on the wood of these trees.

As to Conifers, they are well represented by *Pinus densiflora* S et Z and *Pinus Thunbergii*, Parl.

These two species of pines form mostly forests by themselves occupying both plains and hills. They flourish in barren districts where most other vegetation fails to grow. They are of rapid growth, the wood being yellowish, white, hard, and elastic with

characteristic durability under water, is extensively used for engineering works as well as for supports in mining. It is also used in joinery and building.

Besides these trees, we have a number of bamboos such as :

Phyllostachys puberula, Munro.—*Ph. bambusoides*, S. et Z.
—*Ph. Mitis*, Riv.—*Ph. Pub. Munro. var. Nigra Makino.*—&c.

Most of them are grown artificially in the plains of Shikoku and Kyushu. Although they are grown in scattered patches, yet a great number are grown and they furnish an important material of commerce as used in furniture making, fancy work &c.

III. THE TEMPERATE FOREST ZONE :—Extends from the northern half of Main Island to the southern part of Hokkaido between 36° and 43°5', where the mean annual temperature ranges from 6° to 13° C. The Temperate Forest Zone rises in Formosa to the height of 12,000 ft.; in Shikoku 6,000 ft.; in the central part of the Main Island a little lower, to wit 5,000, ft. and in South Hokkaido 1,500 ft.

These forests cover a large area and not a few of them maintain their primitive features. Being mostly trees valuable as timber, they form the most important item of Japanese sylvan wealth. The chief trees of this zone are undoubtedly conifers. Because of their easy growth, they succeed equally well, either by artificial or by natural generation. In some places, they are found in groups covering considerable area of land, while in others they form mere patches growing alone, or in admixture with broad-leaved trees.

In the central part of the Main Island the upper half of the mountains, and even the hills in the low regions are covered with the trees of the Temperate Zone mentioned below :—

Chamæcyparis obtusa S. et Z.—*Thujopsis dolabrata* S. et Z.,—*Cryptomeria Japonica*. Don.,—*Chamæcyparis Pisiifera* S. et Z.,—*Thuja japonica*, Max.—*Sciadopitys verticillata*, S. et Z.—*Abies firma* S. et Z.—*Thuga Sieboldii* Carr.,—*Pinus parviflora* S. et Z.—*Pinus pentaphylla*, Mayr.—*Pinus Koreiensis* S. et Z.—*Larix leptolepis* Gord &c.—

All of them, have tough, strong wood easy to work not being so hard as that of broad-leaved trees. The timber is extensively used in house, bridge, and ship building, &c. Of these *Chamæcyparis obtusa*, S. et Z., (*Hinoki*) *Cryptomeria japonica* Don., (*Sugi*)

Thuja dolabrata S. et Z., (Hiba) are by far the most valued timber trees of Japan.

A fine species of *Cryptomeria Japonica* Don grows in Yakushima which is specially prized for the beautiful grain termed "Udzuramoku" (partridge-spotted) "Tamamoku" (round-spotted), &c. This timber is especially prized in making valuable household furniture and in house decoration.

Abies firma S. et Z. and *Thuja Sieboldi* Carr are used in making dispatch boxes, tea boxes, and packing boxes. They also furnish the material for the wood pulp industry.

Broad leafed deciduous trees which are quite numerous in this zone, thriving throughout it, occupy more than one half of the whole forest area. They are, however, seldom found forming forests alone except in the case of a few such as *Quercus dentata*, Thunb. *Quercus crispula* Bl., *Betula alba* var. *vulgaris*, Dc, *Populus balsamifera* var. *Suaveolens*, *Alnus Japonica* S. et Z., *Fagus Sylvatica* L. var *Sieboldi* Max. These trees, form forests alone in Main Island and Hokkaido. Other species than those just mentioned, are mostly found together with other broad leafed trees or conifers, sheltering and protecting each other till they attain their splendid full size. Below are given a few important species of this group.

Zelkova Keaki, Sieb.—*Fagus Sylvatica* L. Var. *Sieboldi*; Max.—*Fraxinus mandshurica* Rupr.—*Cladrastis amurensis* B. et H. var *floribunda*. Max.—*Quercus grosseserrata* Bl.—*Acanthopanax ricinifolium* S. et Z.—*Quercus dentata*, Thunb.—*Populus Tremula*, L. var. *villosa*. Wesm.—*Castanea vulgaris* Lam. var. *Japonica* DC.—*Prunus Pseudocerasus*, Lindl. var. *Spontanea* Max.—*Acer pictum*, Thunb var. *Mono*, Maxim —*Aesculus turbinata* Bl.—*Ulmus Campestris* Sm. var, *Laevis*. Planch.—*Cercidiphyllum japonicum*, S. et Z.—*Fraxinus bungeana* Dc. var. *Puvinnervis* Wg.—*Gleditsia japonica* Miq.—They obtain to great size and consequently make timber of high-value. *Zelkova Keaki* is particularly worthy of note, it often attains the great size of 50 ft. in length and 6 or 7 ft. in diameter. The wood being very strong, hard, and durable, is valued for house and ship buildings, and for furniture. Some of the old trees furnish timber with fine grain which is highly prized by joiners and furniture makers. *Acer Pictum*, Thunb var. *Mono*, Max, *Prunus pseudocerasus* Lindl. var *spontanea* Max.,—*Cladrastis*

amurensis var. *floribunda* B. et H. Max also furnish hard wood used by joiners, furniture makers, and wheel wrights works, as well as for ornamental alcoves, etc. Besides these, *Quercus grosseserrata* Bl. is much used for by coopers to make staves of barrels and tubs; *Populus tremula* L. var. *Villosa* Wesm. is used in making shavings to weave into braid for hats and bonnets. *Ulnus campestris* Sm. var. *Laevis* Planch,—*Cercidiphyllum japonicum*,—*Acanthopanax ricinifolium* for furniture and box making; *Aesculus turbinata* for joinery and ornamental cabinet work; *Castanea vulgaris* L. var. *japonica* De, *Fraxinus mandshurica* Rupr, *Fagus sylvatica* L. var. *Sieboldii* Max for sleepers, and engineering and architectural purposes also for boring end; *Petula alba* as fuel in smelting.

IV. THE FRIGID FOREST ZONE:—Occupies, in the northern half of Hokkaido and the Kuriles, those places where the average yearly temperature does not exceed 6°C. In regard to distribution according to altitude, the zone comprises in Formosa those places that are not less than 12,000. ft. from the sea-level and in the middle section of the Main Island all places 5,000. ft. above sea level.

As the forests of this zone, except those in Hokkaido, are located in high altitudes with poor soil, and subjected to strong winds the trees are generally too stunted in growth to be of any value. In Hokkaido, however conifers grow luxuriantly and many primitive forests not yet explored are found. The principal trees in these forests are *Abies Sachaliensis* Mast and *Picea ajanensis* S. et Z. Starting from altitudes of 1,300 ft. in the southern parts of the island, these trees are found growing luxuriantly in the mountains of Ishikari, Teshio, Tokachi, Nemuro and Kitami, and lastly in the Island of Kunajiri. The crown forests at Josankei and Kusharo, the State forests at Shari, and Kunajiri practically consist of extensive forests of these trees alone, presenting a highly regular aspect. The timber of *Abies Sacchaliensis*, most is in large demand for architectural purposes and for use in earth-work, and is indeed the most valuable of all the timber produced in Hokkaido. The wood is, however, coarse grained, and light and is enable to warp when exposed alternately to dryness and humidity. Rather close-grained and resinous, the wood of *Picea ajanensis* is in great demand for architectural work as well as to produce chips for weaving braid hats and bonnets.

Besides these, *Abies Veitchii* Lindl and *Picea Hondoensis* May are found in the frigid zone are only met with on high mountains in the Main Island. They have fine wood, white in colour, soft in texture, and straight in grain. Thus they are highly prized for making window frames, and shingles as well as for use in paper making.

There are many other trees growing in the respective zones, but the principal species are those above described. In nature they are found either growing alone or are mixed with other trees. In general, conifers occupy in the southern districts elevated places while forests in the plains mostly consist of broad leafed trees. In the northern districts conifers cover mountain slopes, while on the ridges and at the foot broad-leafed trees predominate. In Hokkaido generally the upper half of the mountains is crowned with conifers.

On the whole, the different forest zones as represented by their typical species make the following ratio in the forest area of Japan :—

Conifer forests	21%
Broad leafed tree forests	25%
Conifers and broad leafed tree forests	45%
Thinly stocked or devoid of trees	9%
Total	<u>100%</u>

The growing extension of *Pinus densiflora* recently in the Main Island, Shikoku, and Kyushu tended to raise the relative ratio of conifer forests, and this tendency is further accelerated in consequence of the development of industry and business, by the greater demand for such conifers as *Cryptomeria japonica*, Don., *Chamaecyparis obtusa* S. et Z., and *Larix leptolepis* Gord, which are being planted extensively.

In the State forests the relative proportion of the different kinds of forests stands as follows :—

Conifer forests	11%
Broad-leafed forests.....	28%
Conifer and broad leafed forests.....	49%
Thinly stocked or devoid of	12%
Total	<u>100%</u>

The forest areas devoted to conifers will attain before long the

proper ratio to which they are entitled owing to the increasing demand for them.

In the Crown forests, as chosen by the forest aspect, keep more satisfactory proportion between those relations.

Both in the State forests and in the Crown forests the principal trees are, among the conifers: *Pinus densiflora* S. et Z., *Abies sachaliensis*. Mast, *Abies firma* S. et Z., *Abies Veitchii* Lindl., *Picea Hondoensis*, Mayr., *Cryptomeria japonica* Don., *Chamaecyparis obtusa* S. et Z... Among the broad leafted trees the principal species are: *Fagus sylvatica* L. var. *Sieboldii* Max., deciduous and evergreen *Quercus*, *Betula alba* L. var. *vulgaris* D.C., *Castanea vulgaris* Lam. var. *japonica* D.C., *Acer Pictum* Thunb. var. *Mono.* Max., *Prunus pseudo-cerasus* Lindl. var. *spontanea*. Max. *Fraxinus mandshurica*. Rupr &c.

YIELD OF FOREST PRODUCTS.

From the foregoing pages, one can get a fair idea of the immense wealth of the forest resources in this country. To make the matter more clear we shall only add that the average yearly, production of timber was 2,055,159,400 Cubic ft. for 3 successive years (1900-1902), the greater part of which was consumed as building materials and for industrial and mining purposes, while the rest formed an article of export either as timber or in the form of manufactured articles. The value of exports was Yen 2,214,411. for the year 1901, rising however to Yen 2,452,896 in 1902 not including bamboos and other forests products as well as by-products. The last-mentioned products, were exported to the value of Yen 5,970,342 in 1901; and Yen 5,159,060 in 1902.

Thanks to her vicinity to the Continent of Asia, and her natural advantages in having so many sea ports, Japan is well prepared to ship her forest-products to China, Korea and the Islands in the southern seas, which furnish good markets for timber.

Regular services of her mercantile marine and the facility of transport by land have greatly shortened the distance between the

forests and the places of consumption, and have reduce the cost of transport of this massive product of the mountains.

It would be highly advantageous for the intending undertakers of varied works in these countries to use Japanese timber for the construction and in industries, as it is hardly surpassed by the product of any other country, both in quality and price. Ever increasing demand of forest products of world in recent years will further stimulate the production of wood in this country. We have large area of virgin forests in the middle of Japan which are now in the way of utilization, and moreover we are pushing on to increase the timber by replantation of useful trees. Nobody will doubt that Japan only stand in the position to fill the great demand for timber in Orient with safety.

GROUP 653.

DRIED SPECIMENS OF SEEDLINGS OF A FEW IMPORTANT FOREST TREES.

PINUS DENSIFLORA, S. ET Z.

One oz. of the seed contains 33,000,-43,000 seeds. 90% of them germinate. They are sown in the beginning of April in a newly prepared bed at the rate of $1\frac{1}{2}$ oz. of seed for 10 square ft. of ground. Germination follows 3-4 wks afterwards. At the end of the same year the seedlings attain the size of 5-6" long. Transplantation is effected the next year, and is repeated in the year following, at the end of which the seedlings measure fully $1\frac{1}{2}$ -2ft. Strong seedlings are very often planted to form regular forests just after their first transplantation.

PINUS THUNBERGH, PARL.

These seeds are somewhat larger than the preceding running 17,000.—26,000 per oz. The mode of sowing and handling is the

same as with the preceding species, excepting that the seedlings of this pine are stronger and are of more rapid growth.

LARIX LEPTOLEPIS, GORD.

One oz. of seed contains 70,000 seeds. The seed offered in commerce is very poor and only 50-60 % of it germinates. Sown on a well-prepared bed of 10 square ft. at the rate of $1\frac{1}{2}$ oz. of it, in the beginning of April, it germinates 4-5 wks afterwards. As the seedlings are yet too tender to stand the heat of the sun, it is necessary to give them proper shelter. When transplanted into regular fields in the following year, rapid growth sets in, which enables the seedlings to be used as regular nursery stocks on attaining 2 ft. in size. Volcanic ash and dry loam are favourable soils and they thrive even in cold weather.

CRYPTOMERIA JAPONICA, DON.

One oz. of the seed contains about 50,000 seeds. Sow at the rate of $1\frac{1}{2}$ oz. per 10 sq. ft. in the beginning of April; shelter from the strong severe heat for the first year and transplant in two successive years. Fully 3 years after the sowing, the nursery stocks thus grown are planted on regular fields on attaining a height of 1-2 ft. They grow very rapidly and immense quantities are grown throughout the country.

CHAMAECYPARIS OBTUSA, S. ET Z.

One oz. of the seed contain 10,000,—13,000, seeds. The mode of sowing and transplanting is similar to that of those described above. As the growth is slow, three or four successive transplantations are required, before strong nursery stocks can be obtained which will take fully 4 years. Generally, however, 3 years are taken on an average.

CHAMACYPARIS PISIFERA, S. ET Z.

30,000. seeds weigh one oz. The mode of sowing &c. is similar to that described above except that this is of more rapid growth.

QUERCUS SERRATA, BL.

One Oz. of the seed has only 40-50 seeds. In Autumn, well ripened seed is buried in sand to be sown in the open field on

the following April. Four wks after sowing, germination takes place and the plants are fully 1 ft. high at the end of the same year. In the next year the principal root is removed before it is transplanted. Two years fully after the sowing it is transplanted to form regular forests when seedlings are 2 ft. high. This tree makes good fuel.

QUERCUS GLANDULIFERA, BL.

230 Grains weigh one oz. The mode of sowing and handling is similar to that of *Q. serrata* Bl., the only difference is in the more rapid growth.

QUERCUS VIBRAYANA, FR. AND SAV.

One oz. of the seed contains 270 grains. Ripe seed is obtainable at the end of September. It is sowed and handled in the same way as *Q. serrata* Bl. The evergreen broad leafed trees, are more liable to perish easily and when transplanted its growth is very slow. Thus 3 years are required to obtain fully grown nursery stocks.

ZELKOWA KEAKI, SIEB.

One oz. of the seed contain 20,000 grains. The seed ripens at the end of October, and is sown at the end of April in well prepared beds at the rate of one oz. per 10 square ft. of ground.

Five wks after sowing germination sets in, some of the seed however germinates only after a lapse of one year.

As the growth is very rapid, one transplantation suffices before it is planted regularly at the end of 2 years.

CINNAMOMUM CAMPHORA, NEES.

2,700. Grains of their seeds weigh one oz. Ripe seed is gathered in November. The cortex, which encloses the seed is removed when dried. The bare seed thus obtained are stored in a room. In April next it is sown at the rate of $1\frac{1}{2}$ oz. per 10 square ft. of ground.

It germinates well and attains the height of one ft. at the end of the year. Transplantation is effected in the year following. When the seedlings are two ft. high they are planted out in forests. It must be well borne in mind that the principal root should be

removed before the regular planting as otherwise many of the young trees will perish.

HERBARIUMS OF USEFUL JAPANESE BAMBOOS.

The present collection comprises the commonly grown bamboos of great use, corresponding to the collection of stems as classified in the group No. 659.

A few of them are found only in Japan, and indeed some of them are the result of the recent experiments made by our botanists.

Arundinaria Hindsii Munro.

- „ *Hindsii*, Munro., var. *Graminea* Bean.
- „ *japonica* S. et Z.
- „ *Marmorea*, Makino.
- „ *Narihira* Makino.
- „ *quadrangularis*, Munro.
- „ *simoni*, S. et Z. Riv.
- „ *simoni* S. et Z. Riv. var. *Chino*, Makino.
- „ *Totisk* Makino.

Bambusa, nana, Roxb.

- „ *nana*, Roxb. var. *normalis* Makino.
- „ *palmata*, Marliac, forma *nebulosa*, Makino.

Phyllostachys bambusoides, S. et Z.

- „ „ „ var. *aurea* Makino.
- „ „ „ „ *Cassillonis*, Makino.
- „ *Marliaceae* Makino.
- „ *Mitis*. Riv.
- „ „ „ var. *Heterocycla*, Makino.
- „ *Puberula* Munro.
- „ „ „ var. *Boryana* Makino.
- „ „ „ var. *nigra*, Makino.
- „ „ „ var. *nigra*, Makino, forma *nigro-punctata*, Makino.

Sasa poniculata, Makino et Shibata.

Sasa borealis, Makino.

HERBARIUMS OF USEFUL JAPANESE FOREST-PLANTS.

The present collection comprises 260 herbariums of the useful plants, found among Japanese Forests.

They correspond to the collection of wood samples classified under Group 660, while their distribution and their yield are well represented by the respective Chart and Diagram.

The Panoramic view to give adequate forest aspects of these varied forest trees as shown by the annexed photographs.—

GINGKOACEÆ.

Gingko biloba, L. (I cho)

TAXACEÆ.

Podocarpus macrophylla Don. (Maki)

Podocarpus Nageia, R. Br. (Nagi)

Cephalotaxus drupacea, S. et Z. (Inugaya)

Torreya nucifera, S. et Z. (Kaya)

Taxus cuspidata, S. et Z. (Ichii)

ABIE TINÆ.

Pinus densiflora, S. et Z. (Aka-matsu)

„ *Thunbergii* Parl (Kuro-matsu)

„ *Koraiensis*, S. et Z. (Chosen-matsu)

„ *parviflora*, S. et Z. (Himeko-matsu)

„ *pumila*, Pall. (Hai-matsu)

Larix leptolepis, Gord. (Kara-matsu)

Picea hondoensis, Mayr. (Tohi)

„ *bicolor*, Mayr. (Hari-mome)

„ *polita*, Carr. (Matsu-hada)

„ *ajauensis*, Fisch. (Ezo-matsu)

„ *Glehni*, Mast. (Shinko-matsu)

Tsuga Sieboldi, Carr. (Tsuga)

Tsuga diversifolia, Maxim. (Kometsuga)

Pseudotsuga japonica, Shirasawa (Togasawara)

Abies firma, S. et Z. (Momi)

„ *homolepis*, S. et Z. (Dakemomi)

„ *Veitchii* Lindl. (Shiramomi)

„ *Mariesii*, Mast. (Aomori-todomatsu)

„ *sachalinensis*, Mast. (Todomatsu)

Thujaopsis dolabrata, S. et Z. (Hiba)

Thuja japonica, Maxim. (Kurobo)

Chamaecyparis obtusa, S. et Z. (Hinoki)

- Chamaecyparis pisifera*, S. et Z. (Sawara)
Cryptomeria japonica, Don. (Sugi)
Cunninghamia sinensis, R. Br. (Koyosan)
Sciadopitys verticillata, S. et Z. (Koya-maki)
Juniperus rigida, S. et Z. (Nezumi-sashi)
 „ *chinensis*, L. (Byakushin)
 „ *chinensis*, L. Var. *procumbens*, Endl. (Hai-byakushin)

JUGLANDACEÆ.

- Platycarya strobilacea*, S. et Z. (No-gurumi)
Pterocarya rhoifolia, S. et Z. (Sawa-gurumi)
Juglans sieboldiana Maxim. (Oni-gurumi)
 „ *regia* L. var. *sinensis* Cas. (Teuchi-gurumi)
 „ *cordiformis*, Maxim. (Hime-gurumi)

MYRICACEÆ.

- Myrica rubra* S. et Z. (Yama-momo)

SALICACEÆ.

- Populus tremula*, L. Var. *villosa*, Wesm. (Yamanarashi)
 „ *balsamifera*, L. Var. *suaveolens* Loud. (Deronoki)
Salix Buergeriana Miq. (Osaruko-yanagi)
 „ *Caprea* L. (Saru-yanagi)
 „ *purpurea* L. var. *multinervis* (Fr. et Sav.) Matsunura (Kori-yanagi)
 „ *viminialis* L. (Kinu-yanagi)
 „ *opaca* Anders. (Onoe-yanagi)
 „ *triandra* L. var. *nipponica* (Fr. et Sav.) v. Seemen (Tachi-yanagi)

BETULACEÆ.

- Carpinus laxiflora*, Bl. (Aka-shide)
 „ *yedoensis*, Maxim. (Inu-shide)
 „ *Japonica*, Bl. (Kuma-shide)
Betula alba, L. var. *communis*, Rgl. (Ma-kamba)
 „ *alba*, L. var. *vulgaris*, Dc. (Shira-kamba)
 „ *Corylifolia* Rgl. et Max. (Urajiro-kamba)
 „ *Erinanni* Cham. var. *nipponica*, Maxim. (Take-kamba)
 „ *globispica*, Shirai. (Jizo-kamba)
 „ *Maximowicziana*, Rgl. (Udai-kamba)
 „ *Bhojpatra*, Wall. var. *typica*, Rgl. (Ono-ore)
Alnus japonica, S. et Z. (Hannoki)
 „ *viridis*, DC. var. *Sibirica*, Rgl. (Miyama-hannoki)
 „ *incana*, Willd. var. *glauca*, Ait. (Yama-hannoki)
 „ *glutinosa* Willd. var. *vaponica* Matsumura (Kawara-hannoki)
 „ *emerginata*, Matsumura. (Yahazu-hannoki)
 „ *firma*, S. et Z. (Yashabushi)
 „ *firma*, var. *multinervia*, Rgl. (Hime-yashabushi)
Corylus rostrata Ait. var. *Sieboldiana* Maxim. (Tsuno-hashibami)

FAGACEÆ.

- Fagus sylvatica*, L. var. *Sieboldi*. Maxim. (Buna-noki)
 „ *japonica*, Maxim. (Inubuna)
Castanea vulgaris Lam. var. *japonica*, DC. (Kuri)
Pasania cuspidata, Oerst. (Shiinoki)
 „ *glabra*, Oerst. (Mateba-shii)
Quercus glandulifera, Bl. (Konara)
 „ *grosseserrata*, Bl. (Mizu-nara)
 „ *crispata*, Bl. (Ô-nara)
 „ *aliena*, Bl. (Nara-gashiwa)
 „ *dentata*, Thunb. (Kashiwa)
 „ *variabilis*, Bl. (Abe-maki)
 „ *serrata*, Thunb. (Kunuki)
 „ *acuta*, Thunb. (Aka-gashi)
 „ *Vibrayeana* Fr. et Sav. (Shira-kashi)
 „ *glauca*, Thunb. (Ara-kashi)
 „ *myrsinaefolia*, Bl. (Urajiro-gashi)
 „ *sessilifolia*, Bl. (Tsukubane-gashi)
 „ *phyllireoides* A. Gr. (Imame-gashi)
 „ *gilva*, Bl. (Ichii-gashi)
 „ *thalassica*, Hce. (Shirifuka-gashi)

ULMACEÆ.

- Ulmus campestris* Sm. (Harunira)
 „ *campestris* Sm. var. *vulgaris* Planch. (Kobu-nira)
 „ *parvifolia*, Jacq. (Akinire)
Zelkova Keaki, Sieb. (keyaki)
Celtis sinensis, Pers. (Enoki)
Aphananthe aspera, Planch. (Mukunoki)

MORACEÆ.

- Marus alba* L. var. *stylosa* (Kuwa)
Cudrania triloba Hcc. (Hari-guwa)
Broussonetia Kazinoki Sieb. (Kôzo)
Broussonetia papyrifera, Vent (Kajinoki)
Ficus erecta Thunb. (Inu-biwa)
 „ *erecta* var. *Sieboldi* King. (Hosoba-inubiwa)
 „ *Wightiana*, Wall. var. *japonica* Miq. (Ako)
 „ *retusa* L. var. *Nitida* Miq. (Gatsumaru)

PROTEACEÆ.

- Helicia cochinchinensis* Lour. (Yamamo-gashi)

SANTALACEÆ.

- Buckleya quadriala* B. et H. (Tsukubane)

MAGNOLIACEÆ.

- Magnolia hypoleuca*, S. et Z. (Honoki)
 „ *Kobus*, DC. (Kobushi)

- Magnolia parviflora*, S. et Z. (Ōyamarengé)
 „ *salicifolia*, Maxim. (Tamu-shiva)
Michelia compressa, Maxim. (Ogatananoki)
Illicium Anisatum, L. (Shikimi)

TROCHODENDRACEÆ.

- Cercidiphyllum japonica*, S. et Z. (Katsura)
Euptelaea polyandra, S. et Z. (Fusa-zakura)
Trochodendron aralioides, S. et Z. (Yama-guruma)

BERBERIDACEÆ.

- Berberis Thunbergii*, DC. (Me-gi)
 „ *Sieboldi*, Miq. (Hirohano-hebinoborazu)
Nandina domestica Thunb. (Nanten)

MENISPERMACEÆ.

- Cocculus laurifolius* DC. (Koshu-Uyaku)

LAURACEÆ.

- Cinnamomum Camphora*, Nees. (Kusu-noki)
 „ *pedunculatum*, Nees. (Yabu-nikkei)
 „ *sericeum* Sieb. (Maruba-nikkei)
Machilus Thunbergii, S. et Z. (Tabunoki)
 „ *Thunbergii* Var. *japonica* Yatabe (Awo-gashi)
Litsea glauca, Sieb. (Shiro-damo)
 „ *japonica* Tuss. (Hama-biwa)
Lindera strychnifolia Vill. (Tendai-uyaku)
 „ *triloba*, Bl. (Shiro-moji)
 „ *obtusiloba*, Bl. (Dankobai)
 „ *umbellata* Thunb. (Kanakugi-noki)
 „ *glauca*, Bl. (Yama-kobashi)
 „ *sericea*, Bl. (Kuro-moji)
Actinopodophne lancifolia Meisn. (Kago-gashi)
 „ *acuminata* Meisn. (Ao-kagonoki)

SAXIFRAGACEÆ.

- Deutzia scabra* Thunb. (Utsugi)
Philadelphus coronarius L. var. *Satsumi* Maxim. (Baikawa-utsugi)
Hydrangea paniculata Sieb. (Nori-noki)
 „ *scandens* Maxim. (Goto-zuru)
Schizophragma hydrangeoides, S. et Z. (Yuki-kazura)

PITTOSPORACEÆ.

- Pittosporum Tobira*, Ait. (Tobera-no-ki)

HAMAMELIDACEÆ.

- Hamamelis japonica*, S. et Z. (Mansaku)
Distylium racemosum, S. et Z. (Isu-no-ki)

ROSACEÆ.

- Pirus Toringo* Sieb. (Zumi)
 „ *Aria*, L. Var. *Kamaonensis* Wall. (Urajiro-noki)
 „ *Miyabei*, Sargent. (Azuki-nashi)
 „ *aucuparia* Gaerten. var. *japonica* Maxim. (Nanakamado)
Pirus sambucifolia, Ch. et Schl. (Miyama-nanakamado).
Prunus macrophylla S. et Z. (Bakuchi-noki)
 „ *Grayana*, Maxim. (Uwamizu-zakura)
 „ *Siori* Fr. Schm. (Shiurizakura)
 „ *Buergeriana*, Miq. (Inu-zakura)
 „ *pseudo-cerasus* Lindl. var. *spontanea*. Maxim. (Yama-zakura)
 „ *spinulosa*, S. et Z. (Rimboku)
 „ *incisa* Thunb. (Mame-zakura.)
Photinia villosa, Dene. (Kama-tsuka)
Amelanchier asiatica, C. Koch. (Zaifuri-boku)
Photinia glabra, Thunb. (Kaname-mochi)
Kerria japonica DC. (Yamabuki)
Bhaphiolepis japonica S. et Z. (Sharimbai)

LEGUMINOSÆ.

- Sophora japonica*, L. (Enju)
 „ *platycarpa*, Maxim (Fuji-ki)
 „ *Sikokiana* Makino. (Yuku-noki)
Cladrastis amurensis, B. et H. var. *floribunda*, Maxim. (Inu-enju)
Albizia julibrissin, Boiv. (Nemu-noki)
Lespedeza bicolor Jurcz. (Hagi)
Gleditschia japonica, Miq. (Saikachi)

RUTACEÆ.

- Zanthoxylum piperitum*, DC. (Sansho)
 „ *schinnifolium*, S. et Z. (Inu-zansho)
Orixa japonica Thunb. (Kokusagi)
Skimmia japonica Thunb. (Miyama-shikimi)
Phellodendron amurense, Rupr. (Kiwada)

SIMARUBACEÆ.

- Picrasma ailanthoides*, Pl. (Nigaki)

MELIACEÆ.

- Melia japonica*, Don. (Sendan)

EUPHORBIACEÆ.

- Daphniphyllum macropodum*, Miq. (Yuzuriha)
 „ *glaucescens*, Bl. (Hime-yuzuriha)
Mallotus japonica, Muell. Arg. (Akame-gashiwa)
Excoecaria japonica Muell. Arg. (Shiroki)
Sapium sebiferum Roxb. (Nankin-haze)

BUXACEÆ.

Buxus sempervirens, L. (Asama-tsuge)

ANACARDIACEÆ.

- Rhus vernicifera*, DC. (Urushi)
 „ *trichocarpa* Miq. (Yama-urushi)
 „ *succedanea*, L. (Haze-noki)
 „ *silvestris*, S. et Z. (Yama-haze)
 „ *semi-alata* Murr. var. *Osbeckii*, DC. (Fushi-noki)

AQUIFOLIACEÆ.

- Ilex crenata*, Thunb. (Inu-tsuge)
 „ *pedunculosa*, Miq. (Soyogo)
 „ *rotunda*, Thunb. (Kurogane-mochi)
 „ *integra*, Thunb. (Mochi-noki)
 „ *latifolia*, Thunb. (Tarayō)
 „ *Oldhami* Miq. (Nanami-noki)

CELASTRACEÆ.

- Euonymus europaea*, L. var. *Hamiltoniana* Maxim. (Mayumi)
 „ *alata*, C. Koch. (Nishiki-gi)
 „ *oxyphylla*, Miq. (Tsuru-bana)
 „ *japonica*, Thunb. (Masaki)

STAPHYLEACEÆ.

- Staphylea bumalda*, S. et Z. (Mitsuba-utsugi)
Euscaphis staphyleoides, S. et Z. (Gonzui)
Turpinia pomifera DC. var. *nepalensis* Hiern. (Yama-deki)

ACERACEÆ.

- Acer palmatum*, Thunb. (Kaede)
 „ *Tschonoskii* Maxim. (Mine-kaede)
 „ *micranthum*, S. et Z. (Ko-minekaede)
 „ *parviflorum*, Fr. et Sav. (Tetsu-kaede)
 „ *pictum*, Thunb. (Itaya-kaede)
 „ *purpurascens*, Fr. et Sav. (Kaji-kaede)
 „ *pictum* Lam., var. *ukurunduens* Maxim. (Ogara-bana)
 „ *japonica* Thunb. (Hauchiwa-kaede)
 „ *argutum*, Maxim. (Asanoha-kaede)
 „ *cratægifolium*, S. et Z. (Me-urinoki)
 „ *Ginnala*, Maxim. (Karakogi-kaede)
 „ *distylum*, S. et Z. (Hitotsuba-kaede)
 „ *nikense*, Maxim. (Megusuri-noki)
 „ *carpinifolium*, S. et Z. (Yamashiba-kaede)
 „ *rufinerve*, S. et Z. (Urihada-kaede)

HIPPOCASTANACEÆ.

- Aesculus turbinata*, Bl. (Tochi-noki)

SAPINDACEÆ.

- Sapindus Mukurosi*, Gaertn. (Mokuroji)
Koelreuteria paniculata Laxm. (Mokugenji)

SABIACEÆ.

- Meliosma myriantha*, S. et Z. (Awabuki)
 „ *tenuis*, Maxim. (Miyama-hohoso)
 „ *pungens* Wall. (Yama-biwa)

RHAMNACEÆ.

- Berberchia racemosa*, S. et Z. (Kuma-yanagi)
Rhamnus crenata, S. et Z. (Iso-noki)
Microrhamnus franguloides Maxim. (Neko-no-chichi)
Hovenia dulcis Thunb. (Kemponashi)

ELÆOCARPACEÆ.

- Elæocarpus photinicefolia* H. et A. (Magashi)
 „ *japonica* S. et Z. (Koban-mochi)

TILIACEÆ.

- Tilia cordata*, Mill. var. *japonica*, Miq. (Shina-no-ki)
 „ *Miqueliana*, Maxim. (Bodaiju)
 „ *Maximowicziana*, Shirasawa. (Oba-bodaiju)
 „ *Kiusiana*, Makino et Shirasawa. (Hera-no-ki)

THEACEÆ.

- Thea japonica*, (L) Nais. (Tsubaki)
Stewartia pseudocamellia, Maxim. (Natsu-tsubaki)
Eurya ochracea, Szysz. (Sakaki)
 „ *japonica*, Thunb. (Hi-sakaki)
Taonabo japonica Szysz. (Mokkoku)

STACHYURACEÆ.

- Stachyurus præcox*, S. et Z. (Ki-fuji)

GUTIFERÆ.

- Hypericum chinense* L. (Biyo-yanagi)

FLACOURTIACEÆ.

- Idesia polycarpa*, Maxim. (Ii-giri)

THYMELÆACEÆ.

- Edgeworthia chrysantha* Lindl. (Mitsumata)

ELÆAGNACEÆ.

- Elæagnus umbellata* Thunb. (Aki-gumi)

LYTHRACEÆ.

- Lagerstroemia indica* L. (Saru-suberi)

RHIZOPHORACEÆ.

Jambosa vulgaris DC. (Futomomo)

ARALIACEÆ.

Fatsia japonica Dene. et Planc. (Yatsude)
Aralia sinensis, L. (Tara-no-ki)
Dendrodanax japonica Seem. (Kakure-mino)
Acanthopanax ricinifolium, S. et Z. (Hari-giri)
 „ *sciadophylloides*, Fr., et Sav. (Koshi-abura)
Acanthopanax innovans, Fr. et Sav. (Takano-tsumo)
Helwingia rusciflora Willd. (Hana-ikada)

CORNACEÆ.

Cornus Kousa Buerger, (Yama-boshi)
 „ *officinalis* S. et Z. (Sanshiyu)
 „ *macrophylla*, Wall. (Mizuki)
 „ *ignorata*, C. Koch. (Kumano-mizuki)
Marlea platanifolia S. et Z. (Urinoki)
Aucuba japonica Thunb. (Aoki)

CLETHRACEÆ.

Clethra barbinervis S. et Z. (Ryobu)

ERICACEÆ.

Rhododendron Metternichii S. et Z. (Shakunage)
 „ *Keiskei* Miq. (Hikage-tsutsuji)
 „ *dilatatum* Miq. (Mitsuba-tsutsuji)
Triptaleia paniculata S. et Z. (Ho-tsutsuji)
Pieris japonica Thunb. (Asebi)
Leucothoe Grayana Maxim. (Hanahiri-noki)
 „ *Keiskei* Miq. (Iwa-nanten)

SOPOTACEÆ.

Sideroxylon ferrugineum H. et A. (Aka-tetsu)

SYMPLOCAEÆ.

Symplocos cratagoides Ham. (Sawa-futagi)
 „ *myrtaea* S. et Z. (Hai-no-ki)
 „ *prunifolia* S. et Z. (Kuro-bai)
 „ *japonica*, DC. (Kuroki)
 „ *neriifolia*, S. et Z. (Mimizu-bai)
 „ *spicata* Roxb. (Kanzaburō-noki)

STYRACACEÆ.

Halesia corymbosa (Asagara)
Styrax japonica, S. et Z. (Ego-no-ki)
 „ *Obassia*, S. et Z. (Haku-umboku)

OLEACEÆ.

- Fraxinus Bungeana*, DC. var. *pubinerves*, Wg. (Toneriko)
 „ *longicuspis*, S. et Z. (Aotago)
 „ *Sieboldiana*, Bl. (Shioji)
Ligustrum Ibota, Sieb. (Ibota-no-ki)
 „ *japonica* Thunb. (Nezumi-mochi)
Osmanthus Aquifolium, B. et H. (Hiiragi)
 „ *fragens* Lour. (Mokusei)

BORRAGINACEÆ.

- Ehretia macrophylla*, Wall. (Maruba-chishanoki)

VERBENACEÆ.

- Callicarpa japonica* Thunb. (Mi-murasaki)
Vitex Negundo, L. (Ninjin-boku)
Clerodendron tricotomum (Kusagi)

SCROPHULARIACEÆ.

- Paulownia tomentosa* (Thunb.) H. Ba. (Kiri)

BIGNONIACEÆ.

- Catalpa Koempferi*, S. et Z. (Ki-sasage)

CAPRIFIACEÆ.

- Viburnum dilatatum*, Thunb. (Gamazumi)
 „ *Sieboldi* Miq. (Gomagi)
 „ *tomentosum*, Thunb. (Yabu-demari)
 „ *Opulus*, L. (Kamboku)
 „ *furcatum*, Bl. (Mushikari)
 „ *odoratissimum*, Ker. (Sango-ju)
Diervilla grandiflora S. et Z. (Hakone-utsugi)
 „ *japonica* DC. (Tani-utsugi)

GROUP 633.

WORKING PLAN OF THE STATE FOREST OF UCHIMAPPE, AOMORI.

The tract where the present working plan is in effect covers an areas of 8176.9 acres occupying the north-western section of the Aomori Major Forest Reserve. It is one of the three splendid forests.

in Japan and is composed purely of *Thujoponis dolabrata* S. et Z. (Hiba) with an estimated total of 31,000,000 cubic ft. of standing timber, or 3,800 cubic ft. per acre.

From olden times, when the means of conveyance were very primitive, the forest has continued to supply valuable timber to the northern coast of Japan and the output has increase in quantity in our days. The superiority of the *Thujopsis* wood is well known, it being durable in water, with no trace of shrinkage, which quality makes it especially valuable for use in building and joinery.

1. AREA AND BOUNDARIES ;—The following figures will serve to give an idea of the area and extent of the division of the forests, under different managements.

Total Working Circle 8,176.90 acres	{	Area under Ordinary Exploitation	7,513.95
		acres.	
		Area under Partial Exploitation	555.20
		acres.	
		River bed running through the forest.	
		107.75 acres.	

The tract of Uchimappe fronts the bay of Aomori on the East with grass covered hills and plains between. On the north it is separated from the neighbouring State forest within the jurisdiction of the Kanita Minor Forest Reserve by a single divide. On the South it has the city of Aomori and a few forests under the jurisdiction of the Aomori Minor Forest Reserve from which it is separated by a divide.

2. LOCALITY ;—The volcanic range that forms the main ridge of the peninsula of Tsugaru is the habitat of the *Thujopsis dolabrata*, S. et Z. of which the Forest of Uchimappe is the nucleus.

It begins at the South-west end of Tsugaru peninsula extending between 40°51' and 41° of latitude and between 140°34' and 140°40' of longitude. Thus it comprises the valley of the River Ushirogata with long strips lying along Uchimappe and Okunai rivers till they reach the River Setoshi measuring fully 7 miles in length. As mentioned before, this region fronts the Bay of Aomori on the East and is separated from other State Forests by divides. There are five rivers traversing the tract, two of them for a distance of 5 miles and the shorter ones for not more a mile. All the rivers afford good means of transport. The underlying rock is principally of tertiary

formation being mostly tuffs, sand stone, and slate. The soil is light and contains much sand. Thus when the forest gets thin, or is destroyed by excessive felling, the land is easily washed away.

Being situated at the northern extremity of the Main Island and being washed by the cold currents coming from the Arctic and being made still colder by the Northern winds, the tract has a very severe climate in Winter, while in Autumn and Summer, on account of the warm current from the South, the temperature rises considerably.

The prevailing wind of this headland is West, and it is often visited by the south-west typhoon which does considerable damage to the district.

From the botanical point of view the whole tract, as it lies, is within the northern part of the temperate zone and it may be taken to be the coldest part of the Main Island. According to the return of the meteorological observatory of Aomori, the maximum temperature in the year is 32.5 C., in September, falling to 0.15 in February, the average temperature is 9° C and the average moisture 78%.

3. FOREST VEGETATION :—*Thujopsis dolabrata* S. et Z. which is the principal tree of the forest was strictly protected from injudicious felling during the feudal régime. It has since then, been subjected to what is called "Shelter wood compartment system" of our days. The growth of this valuable tree is limited to 82% of the whole tract.

It is well to mention here a few species which are also found in the forest though they are not so common as the *Thujopsis dolabrata*, S. et Z. They are, among conifers, *cryptomeria japonica* Don., *Pinus densiflora* S. et Z. *Pinus parviflora*, S. et Z. *Cephalotaxus drupacea*, S. et Z. and among broad leaved trees *Quercus glandulifera*, Bl. *Magnolia hypoleuca* S. et Z. &c. The greater part of the forest consists of full grown trees while younger trees are but seldom met with. The arrangement is as follows :—

System of Working	Barren or Thinly Wood land	PERIOD.								Restricted Land and River bed	Total.
		I	II	III	IV	V	VI	VII	VIII		
Preregeneration system of Thujopals dolabrata S. et Z.	80.21	37.63	216.26	55.40	...	...	19.97	187.17	5507.62	662.95	6,767.20
Clear-cutting system of Cryptomeria Japonica Don.	230.87	533.37	463.87	80.61	...	...	5.57	5.95	89.43	—	1,409.70
Total	331.08	571.00	680.12	136.04	...	...	25.54	193.12	5597.05	662.95	8,176.90

4. FUTURE YIELD:—The results of the recent investigation regarding the standing timber, the number of forest trees, diameter, height, and growth of the crops are represented by the annexed diagrams :—

DIAGRAM OF THE AVERAGE NUMBER OF TREES PER ACRE
ON
A BASIS OF AGE.

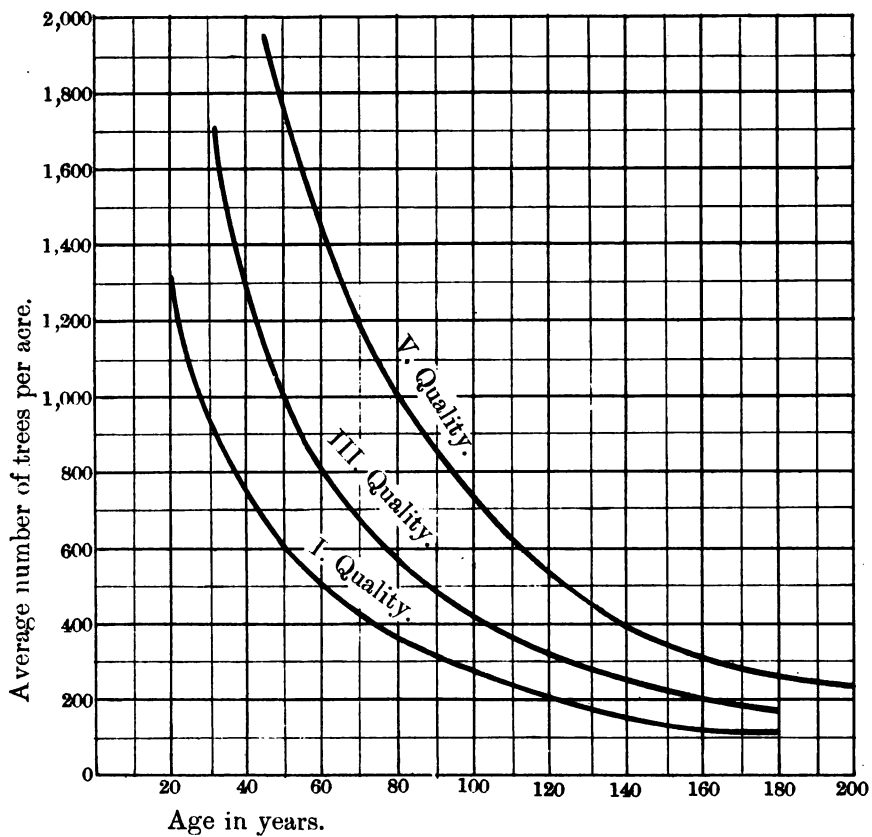


DIAGRAM SHOWING THE MEAN HIGHT INCREMENT
ON
A BASIS OF AGE.

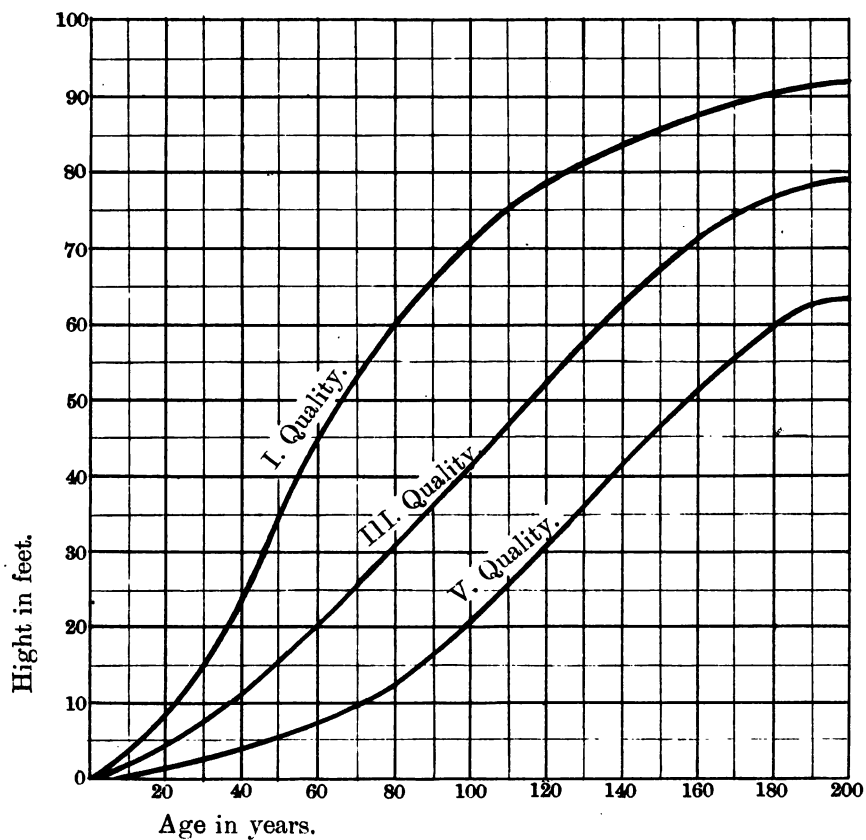


DIAGRAM OF THE MEAN BASAL DIAMETER INCREMENT
ON
A BASIS OF AGE.

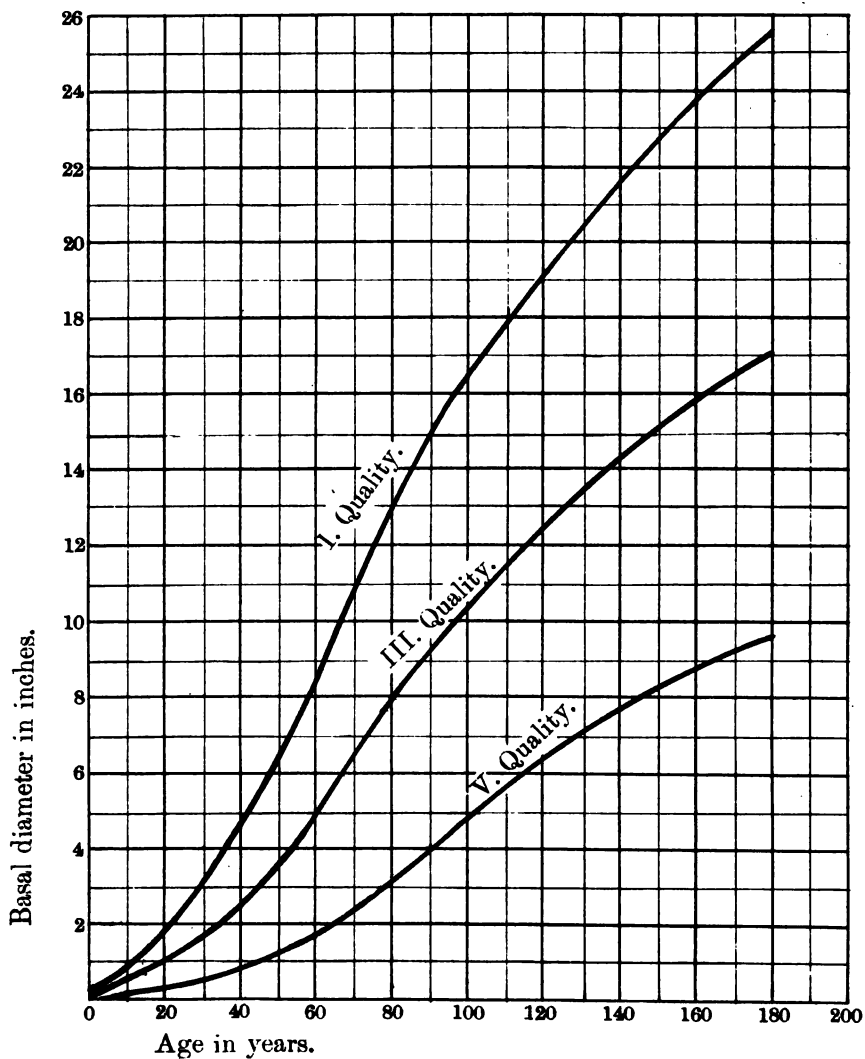




DIAGRAM OF THE VOLUME INCREMENT PER ACRE

ON
A BASIS OF AGE.

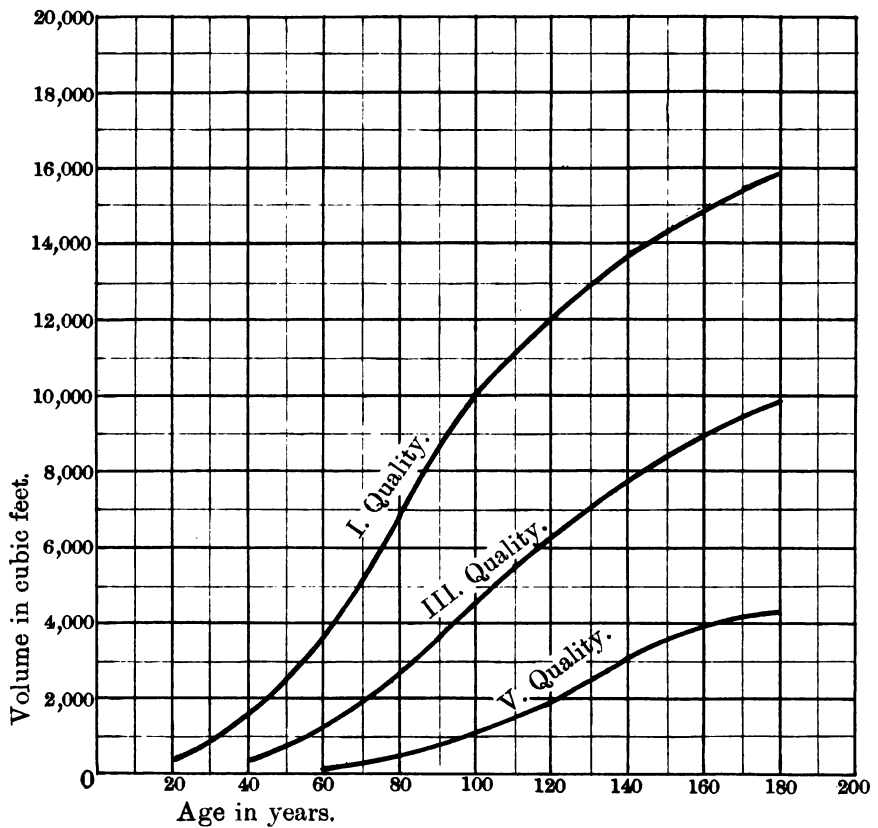
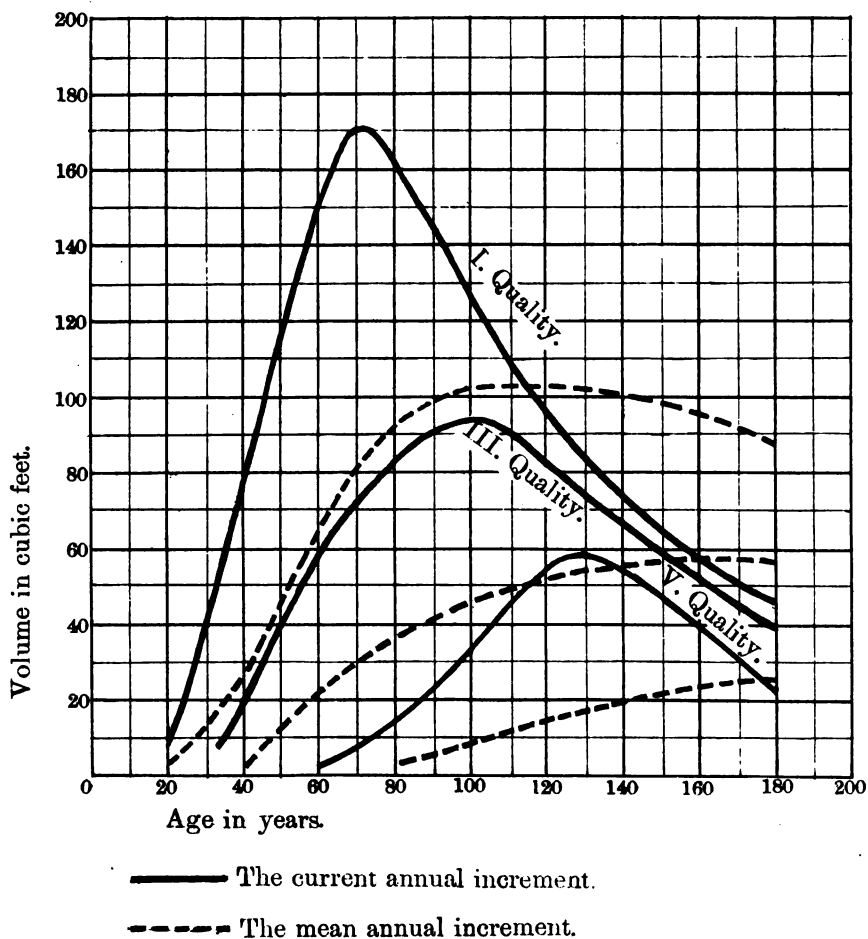


DIAGRAM SHOWING THE CURRENT ANNUAL AND MEAN
ANNUAL INCREMENT OF THE VOLUME PER ACRE
ON
A BASIS OF AGE.



5. ALLOTMENT:—The entire area is divided into 46 compartments for the sake of convenience of transporting forest products, paying due consideration as to the possible equal size each compartment. The compartments, thus formed are again subdivided into 335 subcompartments, each of which in turn is again arranged into 10 series to effectuate the complete felling. They are numbered from W. to E., or from the mouth of the river upwards.

6. LOGGING:— Various methods of logging, common to the region for centuries, give the products as follows:—

(1.) SQUARE TIMBER:—Logs of 6–14 ft., of 0.4–2 ft. diam. at the top section are hewn into square timber.

(2.) PLANKS:—Timber is sawn into planks of different sizes 6–12 ft. long 0.2–1 ft. broad and 0.2–0.4 ft. thick.

(3.) SHAFTS:—3 inches broad $9\frac{1}{2}$ – $12\frac{1}{2}$ ft. long with a thickness of 0.7–1 inches.

(4.) RAFTERS:— $9\frac{1}{2}$ – $12\frac{1}{2}$ ft. long, 2–4 inches broad.

(5.) SPLIT WOOD:—Different sizes to be used for staves and things made of bent wood.

(6.) SHINGLES:—Two kinds are known—Long shingles and Short shingles. The former $1\frac{1}{2}$ – $2\frac{1}{2}$ ft. long 3 inches broad and 0.2 inches in thick. Fifty pieces are made into a bundle; 10 bundles into one lot.

The latter vary from 1 ft.— $1\frac{1}{2}$ ft. in length 3–8 inches in Broad and 0.1–0.3 inches in thickness.

(7.) SHEATHING:—6 ft. long, 3 inches broad and $\frac{1}{8}$ – $\frac{1}{4}$ inches thick is used to support shingles. 50 pieces form one bundle.

Timber is classified into felled and dead; the former is of course by far the most important, being again divided into several classes according to the form freedom from knots, and portion of the tree used, as below:—

Logs: Top section less than 0.7 ft. (Inferior)

„ „ „ „ 1. ft. (Medium)

„ „ „ „ above 1 ft. (Superior)

Planks:

are classified into three classes according to knots:—

Free from knots, (Superior)

With small knots, (Medium)

„ ordinary knots, (Inferior)

Knots smaller than 0.8 inches in diameter are termed small knots.

As classified by the texture :—

Heart wood, (Superior)

Sap „ (Inferior)

As classified by breadth :—

Above 1 ft. (Superior)

Below 1 ft. (Inferior)

The ratio of the timber yield in this forest is very favourable, as the forest is generally well stocked with well grown trees.

According to the usage of the locality above $\frac{1}{2}$ ft. in diameter is used as timber, while the rest of the trunk and others are used for fuel and charcoal making up 86% of available timber wood.

7. PRICE OF TIMBER :—Prices at Aomori market for the timber of Uchimappe are as follows : (yen 1, or yen 1 = about \$ 0.50 U. S., gold)

Logs of <i>Thujaopsis dolabrata</i>		yen 18.00	per 100	Cub. ft.
or „	above 1 ft. diam.	„ 22.00	„ „ „	
	„ below 1 „ „	„ 16.00	„ „ „	
Logs of <i>Cupptomeria japonica</i>		„ 14.00	„ „ „	
or „	above 1 ft diam.	„ 16.00	„ „ „	
	„ below 1 ft. diam.	yen 13.00	„ „ „	
Squared timber of				
<i>Thujaopsis</i>		yen 20.00	„ „ „	
or	Above 1 ft. diam.	24.00	„ „ „	
	below 1 „ „	18.00	„ „ „	
Sq. Timber of <i>Cryptomeria</i>		15.00	„ „ „	
or	Above 1 ft. diam.	17.00	„ „ „	
	below. „ „ „	14.00	„ „ „	

Shingles (3 ft.)

Cryptomeria	{ Superior	yen 1.80	per 1 lot
	{ Ordinary	„ 1.50	„ „
Thujaopsis	{ Superior	„ 1.50	„ „
	{ Ordinary	„ 1.30	„ „

one lot of cryptomeria is composed of 1.000 pieces, while
Thujaopsis 800 pieces.

Shingles (Short).

Cryptomeria	{ Superior	yen 0.18	per 1 lot.
	{ Ordinary	0.15	„ „
Thujaopsis	{ Superior	0.25	„ „
	{ Ordinary	0.20	„ „

PLANKS.

Cryptomeria				Thujopsis			
.04 ft. thick. yen 0.75 per 6 sq ft.				yen 0.95 per 6 sq. ft.			
.07 ft. thick	{	0.80	" " "	for Superior	0.90	"	" "
	{	0.60	" " "	Inferior	0.70	"	" "
.08 ft. "	{	1.00	" " "	Superior	1.10	"	" "
	{	0.75	" " "	Inferior	0.80	"	" "
.09 ft. "	{	1.20	" " "	Superior	1.40	"	" "
	{	0.85	" " "	Inferior	0.80	"	" "
0.1 ft. "	{	0.30	" " "	Superior	1.50	"	" "
	{	0.95	" " "	Inferior	1.05	"	" "

SHAFTS.

Cryptomeria				Thujopsis			
Large...	{	Yen 0.15	Superior quality	}	10 % higher than that cryptomeria.		
	{	" 0.12	Inferior "				
Medium	{	" 0.11	Superior	}	"		
	{	" 0.09	Inferior "				
Small...	{	" 0.045	Superior	}	"		
	{	" 0.035	Inferior "				

SPLIT WOOD.

Cryptomeria				Thujopsis			
Entire..	{	Yen 1.20	Superior	}	30% higher than that of cryptomeria.		
	{	" 0.90	Inferior				
Half.....	{	" 0.60	Superior	}	" " " "		
	{	" 0.45	Inferior				

Stumpage prices in the forest are :—

Thujopsis Yen 10—15. per 100 cubic ft.

Cryptomeria 8—12. " "

From which it is evident that the stumpage price is far lower than the ordinary market price.

The amount of thujopsis dolabrata felled in the State forests within the last ten years is as follows :—

Year.	Unit price per 100 Cubic ft. Yen.	Volume felled in Cubic ft.
1893.....	6.70	675,180.
1894.....	7.25	634,710.
1895.....	5.97	655,452.
1896.....	13.70	649,128.

1897.....	12.30	327,960.
1898.....	9.40	1,112,652.
1899.....	7.85	1,541,280.
1900.....	10.25	1,160,712.
1901.....	10.75	1,493,556.
1902.....	13.02	1,283,760.

The table, shows that the out-put of timber has increased considerably within the last 10 years, with the increase of value for the unit of timber.

8. LABOUR:—Under the feudal government, the care and oversight of the forest, as well as the felling of the trees, were managed by the local authorities. The supply of labour was enough to meet the needs for different kinds of work. They were mostly hardy workers and were skilled in their business. The following figures give the number of the local foresters at present engaged in work:—

Woodmen	250
Sawyers.....	5
Woodsplitters	250
Nurserymen	100
Shingle makers.....	25

In general, wages of such labourers average Y. 0.50 a day and are lower by 40% than those of ordinary artisans such as carpenters, masons, brick layers.

The woodmen mostly live near the forest and carry on different kinds of work such as felling, bough-chopping, logging cropping and the transport of products to the dépôt. They are paid Yen 25—40 per 1,000. cubic ft. for all the work done.

The sawyers form a particular class of workmen being occupied with the sawing of timber into planks which requires special skill. They are divided into three classes with wages varying from Yen 0.30 to Yen 0.80. per day.

WOOD-SPLITTERS are generally paid by piece work. Generally they can split 100 pieces a day and, being paid 8 rin a block, they earn Yen 0.80 a day.

Nurserymen receive on an average about Yen 0.35 a day.

The shingle makers form another class of workmen, requiring

special skill as the price of shingles depends much upon the skill of the workman. The daily work is as follows :—

1500.	3 ft.	Shingles at the rate of Yen 0.40 for par 1,000 pieces.					
1500.	2 ft.	" " "	Yen 0.33	"	"	"	"
2000.	1.8 ft.	" " "	Yen 0.24	"	"	"	"

When different machinery is introduced for such work, as it must be in the future, the rate of wages will naturally rise, but the cost of production will be greatly reduced, as has already been proved in other industries.

9. **TRANSPORTATION** :—Trees are generally felled in Uchimappe between September and January when the snow facilitates the conveyance of timber. The felled trees are cut into the required lengths and collected at certain spots. When the snow is frozen hard, the logs are placed on a trail (Bazu) to be drawn on it. Where the land is sufficiently flat, ordinary sledges are used to carry the timber from the stumpage to the neighbouring rivers. This is termed sliding transportation. The timber thus treated, is thrown into the adjacent river in spring when the water rises after the snow melts. This is termed single drifting. (*Kudanagashi*).

When there is not sufficient water to drift the logs, dams are made along the stream, which are opened at the proper time for drifting.

As single drifting is very objectionable both on account of the damage to the banks and to the timber, it is gradually being replaced by the use of sledges, drays, and other means of transportation.

To give a clear idea of the transportation of timber by single drifting the following table shows the distance from the felling spots to the depôts, thence to the Aomori market by sledges or drays, with the cost of transportation for 100 cubic ft.

Name of Felling Spot.	Distance along the river to the Depot.	Distance between the Depot & Aomori.	Cost of Transportation per 100 Cub. ft.
Setoshi	5 miles	5 miles	Y. 0.40
Okunai	4 miles	5½ miles	(„) 0.35
Mayeda	2½ miles	6 miles	(„) 0.30
Uchimappe	5½ miles	7½ miles	(„) 0.42

10. WORKING PLAN :—As *Thujopsis dolabrata* thrives well in most parts of Uchimappe, owing to climatic condition and the nature of the soil, the area covered now by this trees, will probably be regenerated with it in the future. This is the more likely as it is easily propagated by natural dissemination which greatly economize the cost of planting.

When the land is perfectly barren, or where it was devastated by fire, or where only poor bushes and litters are found, reforestation by *Thujopsis* is too expensive to be successfully effected. In such places *Chamaecyparis obtusa* S. et Z. and *Cryptomeria japonica* Don, are planted instead. The following comparison of these working species may be of use :—

A. Successive Preregeneration system of <i>Thujopsis dolabrata</i> S. et Z. Area of the exploitation 6.104.25 acres.	} Rotatory Age 130 years. Period of re-generation. 20 years.
B. Successive clear cutting system of <i>Cryptomeria japonica</i> , Don. and <i>Chamaecyparis obtusa</i> , S. et Z. Area of Exploitation 1409.70 Acres.	

According to the *Successive Preregeneration* system in which the maximum yield of the timber must be sought, it would be most reasonable to take 145 years as the rotatory age of *Thujopsis dolabrata*. S. et Z. which is of rather slow development especially at first early age, in future, however, some disadvantages will be removed by the improved methods of forest management and by the care extended to young seedlings, we are therefore justified in putting 130 years as the period for rotatory age.

The same principle holds in determining the rotatory age of *Cryptomeria* and *Chamaecyparis* which is taken as 100 years for both species.

As to the period of regeneration 20 year is considered the most appropriate one considering the growth of *Thujopsis dolabrata*, S. et Z.

11. ESTIMATE OF THE YIELD :—In every State forest of Japan, the forest yield is culculated on the mean of the area based on scientific system of these days or in other words, the working periods are regularly restricted to areas of similar size on which

felling is effected. (Die Combinierte Flächen Fachwerk.) Thus, the area of the first period of this working circle is taken to be 85 acres which gives the yield of 456,000 Cub. ft. either for *Thujopsis* and *Cryptomeria* with sundries aggregating yen 26,900. in gross value.

12. REFORESTATION PLAN :—Both *Cryptomeria* and *Chamaecyparis* are planted triangularly 5 ft. apart. Thus, one acre will requires 1,995 seedlings to be planted, out of which 25% will perish during the following year and must be replaced from time to time.

Cares must also be taken in weeding and pruning which is necessary for four successive years, after this they are only cared for every alternate year numbering into 6 for the whole vegetation.

With *Thujopsis*, the care is only extended to every alternate year during regeneration as they fructification does not take place every year, the first year is profitably utilized for the ground laying, the third and fifth years for weeding and pruning, with additional planting of seedlings from time to time.

During the first working period, most of the tract filled together with barren land and thinly wooded land is planted which work requires yen. 25,915 for the whole course of 10 years.

13. ESTIMATE OF RECEIPTS AND EXPENSES :—The Foregoing estimate of the yield and expenses of reforestation leads us to the consideration of receipts and expenses.

It is more convenient to show here the net proceeds for one acre, as compared with the gross proceeds given elsewhere and the difference will show the remarkable increase.

Comparison of receipts and expenses for 10 years as follows :—

Receipts	Disbursement		Net profit a year.
	Reforestation	Management	
yen 269,076.40	19,112,207	6,475,531	24,348,866

The average profit is thus Y. 2.99 per acre which is considerably greater than in former days.

The following exhibits will give further information with regard to the preceeding descriptions :—

MODEL OF THE FOREST OF UCHIMAPPE, AOMORI.

The present model, on the scale of 1:5000, is intended to give

an exact idea as to the general features of the State forest of Uchimappe, its geographical situation and working. Different contrivances used in transportation, as well as the relations with the neighbouring markets are also shown in this model. The whole forest of Uchimappe lies on a gentle slope and presents to the eye the pleasant aspect of a continental forest.

During the feudal regime, under Daimyo, or feudal lord of Tsugaru the original rich vegetation was well preserved and for centuries trees of considerable size furnishing valuable wood were produced. As *Thujopsis* is a strong tolerant tree, constant measures were taken by the same authority to protect the young seedlings. Thus both young and old trees were found growing side by side. Its typical feature had, however, never been lost during the rule. Thanks to the improved method of modern forestry, this forest will hereafter be managed by the profitable system termed "*high wood Pre-regeneration system*."

PHOTOGRAPHS OF THE STATE FORESTS OF UCHIMAPPE, AOMORI.

The annexed photographs will give a general idea of the working of the State Forest of Uchimappe. They reveal at a glance the successful natural regeneration of *Thujopsis dolabrata*, S. et Z. full grown trees just before the rotatory age as well as different modes of fellings, logging, and transport.

The fact that the forest there is located at the northern most part of the Main Island where snow lies on the ground over six months in the year has given rise to the development of different fittings and contrivances perfectly adapted to the peculiar conditions. It would be of interest to the visitor to look at the photographs in connection with the preceding descriptions.

PHOTOGRAPHS.

1. Entire view of *Thujopsis* forests in the State Forest of Uchimappe.
2. Forest aspect of the State Forest of Uchimappe and its surroundings.
3. Ditto.
4. Felling of forest trees in the State Forest of Uchimappe.
5. Ditto.

6. Transportation of timber in the snow by sledges in the State Forest of Uchimappe.
7. Ditto.
8. Dam for drifting logs in the State Forest of Uchimappe.
9. "Piece drifting" of logs.
10. Snow roads in the State Forest of Uchimappe.
11. Lumbermen in the State Forest of Uchimappe.
12. Lumbermen's hut in the State Forest of Uchimappe.
13. Working Office in the State Forest of Uchimappe.
14. Dépôt in the Front of the Minor Forest Office in the State Forest of Uchimappe.

GRAPHICAL DIAGRAMS SHOWING THE YIELD IN THE
STATE FOREST OF UCHIMAPPE.

The present Diagrams represent the yield of timber in the State Forest of Uchimappe, and is prepared according to the "method of Indicating wood plan"—"Weisserbestande-smethode."

These diagrams give the average number of trees found in each 10 years in an area of one acre, mean diameter, mean height, timber stand, and mean and annual increment.

Axis X indicates the age; axis Y the growth of an acre. Thus diagram No. 1 gives the current and mean annual Increment per acre.

No. 2 Volume Increment per acre

No. 3 Mean basal Diameter Increment

No. 4 Average Number of trees.

No. 5 Mean height Increment

All the diagrams show the growth of crops on the land of 1st and 5th classes of quality.

Full particulars connected with the diagram may be obtained from the description given elsewhere.

ANALYTICAL DIAGRAM OF A TRUNK OF *Thujopsis dolabrata*
S. ET Z. IN THE STATE FOREST OF UCHIMAPPE:—

This diagram represents the vertical section of a trunk of *Thujopsis dolabrata* S. et Z. to showing its growth, and was taken from a normal tree, grown on land of the first class in the same Forest.

The standard trunk chosen for this diagram was 190 years old

with a height of 92 ft. and the diameter of 29 inches, the part coloured light brown corresponds to the heart wood, while the vertical lines indicates the year rings.

SPECIMENS SHOWING THE DURABILITY OF *Thujopsis*
dolabrata, S. ET Z.

These specimens aim to show the durability of *Thujopsis dolabrata*, in earth, water, and air as well as its resistance to moisture and weathering.

This old relic made of *Thujopsis* has stood the weather for 83 years being used as a post of castle of the main gate of the residence of Nambu Prince.

Although it is rotten outside, yet inside it still preserves its original strength.

The plank of the same wood, which was originally part of a fishing boat shows well the durability of the wood which had been constantly exposed to sea waters for no less than 84 years.

This water break stay was first driven in the shore of Miumaya, Mutsu, some 45 years ago. It was taken out specially to show here the strength of this useful wood, many of the stays driven at the same time are still found in the same shore serving the original purpose.

The sleepers shown here were first laid in June, 1888, and were removed in July 1902, after 14 years use and consequent exposure to the air and the ground.

NEW SLEEPERS OF *THUJOPSIS DOLABRATA*, S. ET Z.

The present exhibits are made of *Thujopsis dolabrata*, S. et Z. from the State Forest of Uchimappe. Three of them is to be used on bridges; the others on the ordinary track. They both are hewn from a trunk 180 years old with a diameter of 1.8 ft. Sleepers for bridges cost 3 *yen* a piece; while 2 *yen* is the price of a sleeper for ordinary track use.

SQUARED TIMBER HAVING STRAIGHT STRIATION ON TWO SIDES.

The present exhibit is from a *Thujopsis dolabrata* grown in the State Forest of Uchimappe. It shows well the texture and the quality of the wood. It is taken from a tree 190 years old with the diameter of 1.8 ft. worth *yen* 50-60 per 100 cubic ft.

POLISHED LOG OF *Thujopsis dolabrata* S. et Z.

This exhibit was obtained from a *Thujopsis* tree grown in the State Forest of Uchimappe. The bark was carefully removed and it was polished to give a fair idea of its pleasing lustrous appearance.

The tree from which this log was worked, was 50 years old with the diameter of 5 inches costing *yen* 40-50 per 100 Cubic ft.

PLANKS

The planks shown here is obtained from a *Thujopsi dolabrata*s, grown in the State Forest of Uchimappe, which was 190 years old with a diameter of 2 ft. The finished plank costs *yen* 0.04—0.05 per square foot.

Generally the trunk of a *Thujopsis* tree has a perfectly straight grain soft in texture and yellowish white in colour. It often attains the size of 3 ft. in diameter and 180 ft in length. The wood weighs 30 lbs per cubic ft. with a specific gravity of 0.467. When well planed the wood has a beautiful lustre so that it is highly prized for use in building and joinery either as planks or as squared timber. It is also used extensively for utensils, turned articles, etc. As the wood is resinous, it resists well moisture and the weather and it is stronger than any other wood. For these reasons it is prized for foundations, and well-cribs as well as for use in ship building.

The unique forest of *Thujopsis dolabrata* S. et Z. lies within the jurisdiction of the Major Forest Reserve of Aomori, covering 250,000 acres in the peninsula of Tsugaru. Some of the trees there, have already attained their full size so that it is clear that there is an ample supply of this wood. According to the statistics for the past ten years an immense yield of 12,000,000 cubic ft. was obtained exclusively from the State forest. There is promise of a farther supply of 50,000,000 cubic ft. in future annually.

EXPLOITATION OF THE YOSHINO FOREST.

I. INTRODUCTION:—The Exploitation of the Yoshino Forest dates back 400 years and a study of it shows the gradual develop-

ment extending over several centuries. Here we have a good example of the most intensively worked forests of *Cryptomeria japonica*, grown by artificial generation.

It includes the district which forms the county of Yoshino in Yamato, in the southern part of the Main Island. As the land is very mountainous there are many places which are not available for anything but forestry. The mild climate and rich soil are especially suitable to the growth of these trees. The greater part of the land there is covered with trees; while the land used for other purposes, is comparatively little, as is shown by the following figures:—

Total Area	Building land and land under culti- cation	Forest Land	Percentage of Forest land
acres	acres	acres	
226,650.	14,020.	212,480.	93%.

The Forest area is divided as follows:—

Artificial forest of <i>Cryptomeria</i>	Art. forest of <i>Chamaecyparis</i>	Mixed forest of Conifers & Broad leafed trees	Broadleafed trees & Bamboo bushes
38%	12%	34%	16%

The actual area of the artificial forest of *Cryptomeria* is 80,742. acres; that of *Chamaecyparis* 25,497. mixed trees and bamboos cover the remainder but the tendency is to increase the area occupied by *Cryptomeria*. The whole county is well drained by the Rivers Yoshino, Totsukawa and Kitayama, as may be seen by a glance on the map. The three rivers form three divisions each provided with its own facilities of transport so necessary in the development of the Forest industry. The products obtained along the River Yoshino are transported to the mouth of the same river, as well as to the port of Wakayama; these which are originated from the valley of the Kitayama and the Totsukawa are principally sent to Shingū in Kii. Of the two divisions, that of the Yoshinokawa is famous for the production of logs and staves for saké barrels; while that of the Totsukawa and Kitayama furnishes building materials. They both have *Cryptomeria* as their principal forest tree, although there are various other trees.

The *Cryptomeria* timber of Yoshino is extensively known in the South Western part of Japan and is highly prized for its fine

quality and characteristic pleasant odor. The demand for it increases every year as will be seen by the following table having been shipped to Osaka, Wakayama, and Shingu.

Value of Cryptomeria Shipped.

year	Valley of the Yoshino	Valley of the Totsukawa	Valley of the Kitayama	Total
1898	yen 1,609,704.	yen 147,566.	yen 231,386.	yen 1,988,656.
1899	„ 2,061,550.	„ 197,777.	„ 123,303.	„ 2,382,630.
1900	„ 1,615,380.	„ 213,149.	„ 195,245.	„ 2,023,774.
1901	„ 1,419,185.	„ 108,874.	„ 260,387.	„ 1,788,446.
1902	„ 1,695,960.	„ 226,808.	„ 285,260.	„ 2,208,028.
Total	„ 8,401,779.	„ 894,174.	„ 1,095,581.	„ 10,391,354.

The Quantity of Cryptomeria timber shipped from valley of the Yoshino alone stands as follows :—

Year	Volume in cubic ft.
1898	9,962,360
1899	10,388,160
1900	8,171,640.
1901	7,428,780
1902	8,857,032
Total.	44,807,972

The average production is 89,615,944 cubic ft.

Thus the inhabitants of Yoshino district are mostly, engaged in forestry deriving their living from it either directly or indirectly.

It is no wonder that the constant care extended given to this useful industry which forms their unique source of wealth, causes progress in the mode of management which is characteristic to Yoshino. Capital, too is not wanting, and good wages are paid to the labourers. It is indeed not too much to say, that 85% of the local male population consists of planters, woodsmen, sawyers, and timber carriers, some of them are indeed engaged in other provinces as skilled foresters.

Evidently Japan, with its large forest area is deriving much of its riches from the forest resources. It is well known that in many provinces forestry products form an important part of the local resources. There are, however, few districts like that of Yoshino where successive replantation has been systematically carried out for the several centuries as the most lucrative industry of the province.

The main causes, to which might be attributed the success of forest industry in Yoshino may be attributed are :—

1. The establishment of the central seat of government by the Emperor Jimmu, founder of the Japanese Empire as early as 7th century B. C. which gave rise to the subsequent progress and improvement in social as well as industrial life and the consequent advance in architecture, thus stimulated the demand for timber in the early part of our history.

2. The natural features, which are very mountainous with but a few districts available for agricultural purposes while the greater part of the region is not available for anything but forestry.

3. Rivers affording facilities for the transportation of timber.

4. The whole region is held as private property by people of the locality with no hindrances in carrying out forest exploitation.

5. The traditional development of economy favours the industry.

6. An easy access to markets with due facility for obtaining business intelligences.

Forestry in Yoshino, in its present state of importance, is characterized by the following facts :—

1. The Intermediate Yield obtained by successive “Thinnings” plays an important rôle of receipts.

2. The exploitation, there, is effected on the properties of others as developed into a peculiar tenancy system with due harmony and concords between the two parties.

3. As the whole population has a common interest in forestry, the management and working is freed from many difficulties.

In general, the forestry of Yoshino having its traditional development based on a well founded system, and being without injudicious felling, there is good reason to hope that in the future this important industry, will yield for an increased supply of timber in proportion to the social development of the country.

II. LOCATION AND LAND FEATURES :—The County of Yoshino, lying in the Southern part of the Province of Nara consists of 24 villages with a population of 90,000. It is bounded by Isé on the East; Kii on the South and West; and on the North it is connected with the cultivated field of Yamato. It extends from 33° 58' to 34° 30' N. L. and from 135° 20' to 136° 40' E. occupying 67% of

the whole province. It is traversed in all directions by mountain ridges of varied elevations.

The general declivity of the land is between 2° – 40° , a slope of 30° – 40° however predominating.

Cryptomeria is most successfully grown, where the decomposition of the paleozoic formation produces a soil rich in clay with a quantity of sand. It is generally well drained with a suitable proportion of humidity. Near the mountain ridges however, the soil is more sandy and dried.

The low land of this district corresponds to the sub-tropical zone while temperate zones occupies the high part of it. They are visited by storms which prevail in Autumn and do much damage.

Although the whole region is tolerably well provided with different means of transportation, it is still far from being an easily reached tract as the area is very extensive and the hills and mountains which hinder in great degree, communication are very numerous. Indeed, there are still left, many places not yet explored. Nevertheless various methods of transportation which have been in use for hundreds of years together with the rivers, Yoshino, Kitayama and Totsukawa with their tributaries afford communication with almost all the felling points. Timber valued at *yen* 2,000,000 is annually consigned to different parts of the country either by piece drifting or in the form of rafts.

Recently through the efforts of corporations composed of local woodmen, it was decided to open smaller private and communal roads at the expense of the local authorities. This will furnish further means of cheap land transports to be used in connection with river transport.

III. SYLVICULTURE :—As the forest exploitation in Yoshino is so intensive that it partakes more of the nature of agriculture than of forestry, in the strict sense of the term, no labor nor care is spared in the choice of parent trees, the preparation and sowing of seed, and the care of nursery ground. *Chamaecyparis* and *Cryptomeria* are the principal trees for artificial propagation. The former is grown in a nursery-bed for three years, the latter for four years, before they are read for the regular transplantation.

As the forest exploitation in Yoshino aims at what is termed

"Intermediate Yield" the seedlings are planted very closely at first; in some cases as many as 8,000. are taken to cover only one acre; the usual number per acre may, however, be justly taken as 4,000. In most cases *Cryptomeria* seedlings are planted alone, while in other cases both *Cryptomeria* and *Chamaecyparis* are planted together in the ratio of 9 of former to 1 of the latter, for the 1st quality of locality; 7 to 3 for the 2nd quality and in equal proportion for the 3rd quality.

Supplementary planting is effected for two years just after regular transplanting, by which the requisite number of trees is secured.

With *Cryptomeria*, weeding is done twice a year for three successive years, once early in summer and once at mid summer. From the eighth to the tenth year weeding is still necessary as well as the removal of injurious creepers. With *Chamaecyparis*, the same care must be taken once a year for four or five after the transplantation.

Both the *Cryptomeria* and *Chamaecyparis* are pruned from the eighth to the 23rd year after the transplantation. This must be done with a sharp hatchet to cut off all the basal branches. *Cryptomeria* planted in the 1st quality of locality requires pruning till it is 14 years old, while that grown on poorer locality requires pruning till the 23rd year. The *Chamaecyparis*, is further pruned in the 30th, 45th, and 60th years after transplantation.

"Thinning," as it is termed, is a peculiar form of exploitation practised and developed in Yoshino, in connection with the tenancy system there. By the help of close inspection of the canopy of the vegetation and by successive "*Thinning*" the annual growth of every tree is well adjusted to preserve a uniform texture of wood, which is an indispensable factor in producing 1st class trunks free from harmful knots. There is no doubt that pruning has done much to further the progress of forestry in Yoshino which is characterized by the solicitous cares taken by the woodmen of this district.

The first thinning is done, at the earliest, in the 12th year after the transplantation. With *Cryptomeria*, this is done early in the Spring, while with *Chamaecyparis* it is done late in Autumn.

IV. FELLING AND LOGGING :—Unlike the methods of felling in

other places, in Yoshino, the chief aim is to effect the greatest possible economy of forestry. In the felling of the first and second thinnings, or, in other words, before trees are 25 years old they are cut down, leaving stumps 2 ft. high; older trees are cut down close to the ground. It is obvious that with younger trees, the lower part is very irregular in shape so that they are not suited for making into rafts unless such crooked ends are removed, and this additional work would cause considerable trouble. It is also advantageous to leave higher stumps in the forest, as they prevent the slipping of the soil, and also help the woodsmen by affording firm footholds while they are working.

The following are the forest products of Yoshino :—

(1) LOGS :—Different kinds of logs are shown. They are classified by length as 10 ft., 14 ft., 28 ft., and 32 ft. lengths and they differ in diameter from $1\frac{1}{2}$ inches to 2 ft.

(2) POLES :—They are the products of the 1st to the 4th thinnings. They are used for beams, rafters, gratings, etc., and in making ceilings. They are classified by lengths as 7 ft., 10 ft., 14 ft., and 18 ft. lengths.

(3) POLISHED LOGS :—Polished logs are the products of the 5th and the 6th thinnings and are cut in 10 ft., 14 ft., 21 ft., 28 ft. and 35 ft. lengths. Most polished logs have longitudinal slits cut from the surface to the centre of the trunk in order to prevent cracking.

(4) STAVES, TOPS, AND BOTTOMS, FOR SAKÉ CASKS AND FERMENTATION TUBS :—They are either the products of 8th thinnings and successive ones, or of fellings. Staves are classified into seven qualities :—

- 1). Inner red extra "Uchimare "
- 2). Heart-wood, extra "Gokumare "
- 3). Inner red "Uchi aka "
- 4). Extra good "Mare "
- 5). Heart-wood Dark "Kuro "
- 6). Knotty "Fushi "
- 7). Sap wood "Shiro "

(5) BEAMS OF CRYPTOMERIA :—They are made of the products of principal fellings and are mostly of more than 2 ft. in diameter.

(6) OTHER BUILDING MATERIALS :—These are obtained from

the timber of the Kitayama valleys, and are particularly prized for their homogeneous white texture, free from knots. They are extensively used for house building, joinery, and in the making of utensils.

IV. TRANSPORTATION :—For the sake of convenience, we shall consider the subject under two distinct headings :—

Land Transportation.

Water „

Land transportation is of four kinds :—

1. Slides,.....“ Shura ”
2. Carrying on the back“ Katsugi ”
3. Drays“ Kuruma ”
4. Sledges“ Kimuna ”

SLIDES :—There are three kinds of Slides : viz., Earth, Earth and Wood, and Wood.

Earth slides are now but seldom used as they spoil the timber as well as the forest ground, although they are the simplest and by far the most easily made type.

Earth and Wood Slides are made on the ground by laying small pieces of wood or bark on the ground, and forming the sides of the track with square spars or with planks where the declivity and curve require them. In this way a channel is formed which is often watered to minimise the friction of heavy timber.

Wood Slides are made by laying logs side by side to form a channel down which the timber is slidden. In general, these slides are made of the same timber which is being transported. After all the timber which is not used in the slide has been slidden down, the slide itself is taken up, beginning at the top, and slidden down in like manner. The principle of such slides is to utilize the timber to be transported as the means of transportation.

CARRYING ON THE BACK :—This is now limited to those districts where there are no other means of transportation, such as drays and sledges. It was formerly much in use.

DRAYS :—Pine logs of a diameter of $1\frac{1}{2}$ ft. are cut into pieces 5 inches thick. The Discs thus obtained are bored at the centre through which a strong axle 2 ft. long passes. The timber to be transported is supported on the axle, and the whole contrivance

is drawn by a rope fastened to a piece of wood, attached to the end of the piece of timber.

SLEDGES :—Sledge-tracks are mostly 7-10 ft. broad with a declivity of 8%, sometimes even 16%. They are most commonly used along the River Yoshino. The track is laid down as in a railroad with ties two feet apart. The bottom of the sledges is made slippery by means of rape oil.

WATER TRANSPORTATION is of two kinds:—

Piece drifting, ...“ Kudanagashi ”

Raft drifting, ...“ Ikadanagashi ”

Piece drifting is effected by utilizing the stream to carry the timber from the head waters to the timber depot where it is made into rafts. Where there is not sufficient water or where obstacles prevent the drifting of timber, dams are constructed to raise the water. Where there are rocks, the dam is ingeniously made by passing cross bars of wood over them. Where there are no rocks, wood frames are temporarily erected to support cross bars. The interstices of the cross bars thus formed, are filled with moss to prevent leakage. At the centre of the dam thus made a trough is installed, to the lower end of which is affixed a kind of slide. When the door of the trough is lifted the timber runs off on the slide with the stream. When all the timber scattered above the dam is removed, then a similar dam is erected further down with some of the timber drifted thus far successive dammings will thus carry all the timber to the neighbouring depôt.

In raft drifting there are two kinds of rafts termed High Rafts and Main Rafts. The only difference is in the breadth, the former being 4 ft. broad, and the latter 8 ft. In both kinds the length ranges from 14-21 ft. If the component logs are large, they are formed into a single row; if smaller into two rows; or if very small into as many as five rows. Skill is necessary in making rafts, for the standard breadth of 4 ft. must be made out of logs of various sizes. To this end, the woodman picks out logs and poles of suitable size with his hook. The pieces thus chosen are placed on a stand, and holes are then bored at both ends through which strong vines are passed to bind the pieces into a raft. When a raft is made, the description of it, the name of the consignee,

and other marks, are inscribed on one side of it. Then it is plunged into the river, and several other rafts being combined to it a raftsman takes charge of them. The central logs of a raft are left free at their ends and are termed "tabu" or "wedge logs." Where the river is too narrow to allow the passage of an entire raft, the unfastened central "tabu" logs are dislocated from their rows; by this means the breadth of the raft is greatly reduced and the passage can be effected. This is a characteristic of the Yoshino rafts. The length of the compound raft differs greatly. With 18 ft., logs ten rafts, and, with 12 ft. logs, fifteen rafts are fastened together.

In the upper part of rivers where there are many rocks and obstacles two raftsmen are employed to manage one compound raft. In the lower part of rivers one raftsman suffices for this work. The following figures may be taken as giving the average cost of transportation from the stumpage to market of Wakayama.

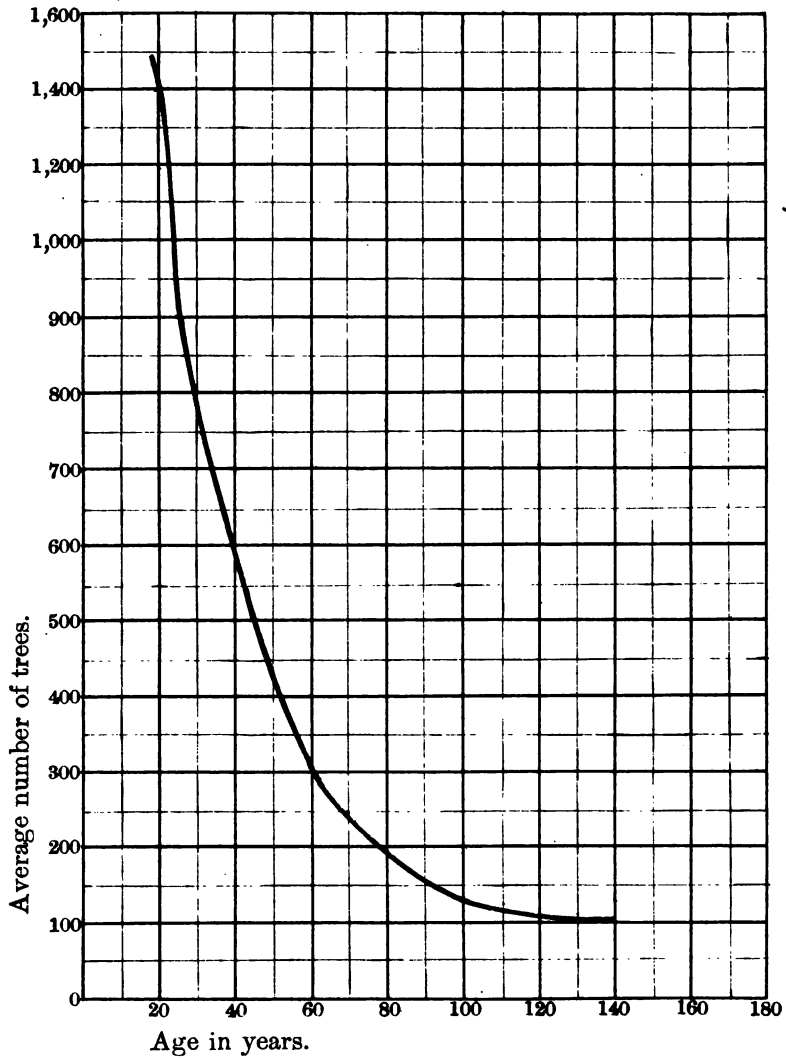
	<i>Yen</i>
Felling and logging.....For 1 raft	0.200
Drayage.....For 1 raft	0.600
Forming of Raft.....At 2 rafts for 1 woodman.....	0.250
Vines 21 lbs	0.325
Wages (Raftsman).....For the distance of 4 miles 6...	0.080
" " " " " " " " 9.6	0.100
" " " " " " " " 6.9	0.060
" " " " " " " " 46 miles ...	0.230
Total	<i>Yen</i> 1.845
Toll-dues	1.620
Brokers Commission at 3% }	0.740
Brokerage .07% }	
Discount 4%	0.880
	<i>Yen</i> 2.440

Thus, the total expenses of transportation aggregate *Yen* 3.90 per 100 cubic ft. of timber for a distance of 67 miles. Formerly all the timber of the Yoshino valleys was forwarded to Wakayama in the form of rafts and thence shipped to Osaka, Nada, &c. Since the

opening of railways in these districts, the timber is now sent to recent Gojō station thence to be sent to Osaka and other places by rail.

VI. FOREST YIELD IN YOSHINO. The yield of the forest of *Cryptomeria japonica*, Don. of Yoshino district is shown in the following diagrams :—

DIAGRAM SHOWING THE MEAN NUMBER OF TREES
PER ACRE ON A BASIS OF AGE.



GROUP 659.

COLLECTION OF USEFUL JAPANESE
BAMBOOS.

This collection shows specimens of typical Japanese bamboos to be studied in connection with the herbarium and photographs.

Phyllostachys Mitis. Riv.

This giant bamboo, of the subtropical zone, grows naturally in Osumi, Hyūga, and Kii, the largest kind attains a height of 50 ft. with a diameter of 0.9 ft. On account of the size and strength, it is extensively used for furniture, flower vases, trays, and domestic utensils, such as pails, etc.

Phyllostachys, Mitis, Riv. var. Hetero-cycla, Makino.

This species belongs to the sub-tropical zone and is found in Tosa and Awa, in great luxuriance. Near the root end, the stem is closely knotted giving it a polygonal shape, very similar to that of a tortoise shell, hence the name. It is used for canes, as well as for furniture.

Phyllostachys Bambusoides, S. et Z.

This species grows abundantly in the sub-tropical zone in the southern part of the Main Island and Kyūshū, and is widely cultivated in Yamashiro. It attains a height of 60 ft., and a diameter of 2-3 inches. As the stem has a uniform size it is extensively used for troughs, pipes, laths, baskets, umbrella ribs, and it is used for ornamental purposes.

Phyllostachys Bambusoides S. et Z. var. Aurea, Makino.

This species of the sub-tropical zone is especially abundant in Hyūga. It attains a height of 30 ft. and a diameter of 3 inches. Near the root, the knots are irregular and well developed giving it the form of a club. It is used for sticks, umbrella handles, fishing rods, etc.

Phyllostachys Marliaceae, Makino, var. Bassilonis, Makino.

It is produced in Awa near Tōkyō; and is used for furniture, and for ornamental purposes in gardens.

Phyllostachys Marliaceae, Makino.

This bamboo grows abundantly in Tosa, Awa, and Awaji, and is very elegant in appearance. It is used for flower vases, pen-holders, pen-stands, and for various ornamental purposes.

Phyllostachys Puberula, Munro.

This bamboo of the tropical zone is found in Yamashiro, Tosa, Musashi, and Echizen. It resembles *Phyllostachys bambuoides* S. et Z.; but it has, however, a smaller diameter and a greater height. As it is very strong and elastic it furnishes suitable material for baskets, blinds, flutes, fishing rods, broom handles, etc. It is easily coloured and for this reason it is valued for furniture manufacture.

Phyllostachys Puberula var. Nigra, Makino.

This species of the sub-tropical zone grows well in Yamashiro and Tosa. It attains a height of 30 ft., and a diameter of 2-2.5 inches. The stem is finely sprinkled with black spots, and it is used for the handles of brooms and umbrellas, canes, and for making fans and furniture.

Phyllostachys Puberula Munro, var. Boryana, Makino.

This bamboo of the temperate zone is abundant in Tamba, Tango, and Omi. It attains a height of 30 ft. and a diameter of 3 inches. The stem is finely spotted, and is used for canes pen-stands, and utensils for serving tea.

*Phyllostachys Puberula Munro, Nigra, Makino, forma nigro,
Punctana, Makino.*

This species grows like the Ph. Pub. Var. Nigra Makino. mentioned above and is used in a similar way.

Arundinaria Simoni, S. et Z. Riv.

This is the most common species of Japanese bamboos, being found everywhere in the Main Island, Shikoku, and Kyushu. It is grown in large quantities, in Awa and Sagami having a height of 15 ft. and a diameter of 2 inches. The joints are very small and the cane is very soft. It is used in making fans, blinds, baskets, laths, fishing rods, and furniture.

Arundinaria simoni, S. et Z. var. Chino Makino.

This bamboo grows abundantly in Sagami, Awa, and Ise to a height of 10 ft. The cane is regular in texture and soft, and is used in making fans, and basket-work.

Arundinaria Hindsii, Munro.

This bamboo grows wild in the southern part of the Main Island and Shikoku. It is valued as an ornamental plant.

Arundinaria Hindsii, Munro, var. graminea.

Like the *Arundinaria Hindsii* Munro, widely distributed in the Sub-tropical zone and is used as an ornamental plant.

Arundinaria Narihira, Makino.

This bamboo grows both in the temperate and Sub-tropical zones, and is valued for furniture manufacture, and as a beautiful garden plant.

Arundinaria Narihira var. (?)

It is abundantly found in Echizen and very much like the preceeding species.

Arundinaria quadrangveris, Munro.

This four sided bamboo is found in the southern part of the Main Island and Kyūshū. It is used for canes and in making furniture.

Arundinaria totisk, Makino.

This species of the sub-tropical zone is rare and it is chiefly valued as a garden plant.

Arundinaria marmorea, Makino.

This species of the sub-tropical zone is found in Awa abundantly. Often shoots numbering several hundreds come out from a single stock and grow 7 ft. high with a diameter of 0.7 inches. As the joints are of odd shapes it is valued in the manufacture of fans, tables, and other fancy articles.

Arundinaria japonica, S. et Z.

Grows throughout Japan and is not more than 7-8 ft. high and $\frac{1}{2}$ inch across. Although having many joints it is very regular and strong and is highly valued for fishing rods, and in the manufacture of fans.

Sasa Poniculata var.?

This bamboo is found mostly in the central part of the Main Island especially in Kaga, Echizen, and Kii. It is about 20 ft. high and 3 inches across, and is extensively used in making furnitures, utensils for serving tea, and for canes.

Bambusa nana, normalis, Makino.

Is a sub-tropical species found in Shikoku, Kyūshū, and the central part of the Main Island. It is used in furniture manufacture and for canes.

Bambusa palmatum, var. nebulosa.

A species of the temperate zone growing in Echizen and Shiribeshi. It is quite rare and is used in furniture manufacture.

Sasa borealis, Makino.

Is found in the northern part of the Main Island especially in Shinano, belonging to the temperate zone. It is 8-9 ft. high and being slender with long branches and plain knots it is valued for materials for baskets of all descriptions. Lately it has been used in making hats and matting.

Sasa poniculata, Makino.

Is found in the northern part of the Main Island and Hokkaidō where other bamboos do not thrive. It fills the gaps in the forests where other vegetation does not thrive. It is 15 ft. high and 1 inch across with a peculiarly crooked stem at the base.

The herbarium corresponding to this exhibit is comprised in Group 653, and also photographs of the Forests of *Phyllostachys Bambusoides* S. et Z. and *Phyllostachys Puberula*, Munro, belonging to the State, and of the operations of felling, trimming, raft-making, and transportation.

Bamboo has been successfully grown in different parts of Japan for centuries, but in limited areas. The bamboo produced in 1903 amounted to 28,968,728 canes. Exports of bamboo and manufactured articles amounted to *Yen* 735,357.

GROUP 660.

TIMBER USED IN BUILDING. .

CHAMAECYPARIS OBTUSA S. ET Z.

The tree grows both in the temperate and Sub-tropical Zones forming natural forests of considerable size of which the Kiso forest is the most remarkable. Shimotsuke, Musashi, Kii, and Tosa are well known also for their natural forests of this tree. It is also artificially grown in general districts.

This timber is used in house, ship, and bridge construction and is also used in making furniture. By bending thin pieces of this wood various utensils are made. The wood is also used as the ground of lacquer work. As the wood is strong and compact in texture, besides the above uses it is used in making models, and chips of it are also made into chip-braid and matting. Larger chips are formed into strong ropes used in rafting. The bark is used for roofing and in making ropes. The leaves yield an essential oil when distilled.

No other wood is so widely used in Japan. The price in Tokyo is about *Yen* 80 per 100 cubic ft.

CRYPTOMERIA JAPONICA S. ET Z.

This conifer belongs to the Temperate Zone. It is now grown artificially throughout the whole country, especially in Ugo and Yoshino.

It is one of the most extensively used timber-trees. It is used in house, bridge, and ship, building, and in making saké casks. The bark, too is useful for roofing, and as a good substitute for weather-boards. The leaves are used in making incense and an essential oil. The price in Tokyo is *Yen* 50 per 100 cubic ft.

ABIES SACHALIENSES MAST.

Belongs to the Frigid Zone, being found mostly in Hokkaido.

It is used in house and ship building, and furniture and paper manufacture.

The price in Tokyo is *Yen* 45 per 100 cubic ft.

PICEA AJANENSIS FISCH.

Belonging to the Frigid Zone, it is found in the Northern part of Hokkaido in great abundance.

It is a valuable timber in house and ship building; and is used for masts, in making utensils, &c. Its use in the paper industry will cause an increased demand.

The price in Tokyo is *Yen* 45. per 100 cubic ft.

LARIX LEPTOLEPIS GORD.

The tree grows in the Temperate Zone especially in Shinano, Fuji, and Nikko. It is lately grown artificially in other districts.

The wood which is of a brown colour and of fine texture is used both for decorative and constructive purposes, being very suitable for pillars, entrances etc. In ship and bridge building it is invaluable, while for telegraph poles, sleepers, etc., the demand for it is unlimited. An old resinous piece having a good lustre is prized for making curios such as trays, tobacco-holders, etc. The bark is rich in tannin and makes a good dye. The soft elastic bark is also very suitable for making fences and for other uses. Resin is made from the wood.

The price in Tokyo is *Yen* 55 per 100 cubic ft.

PINUS DENSIFLORA S. ET Z.

Thriving in the Temperate as well as the Sub-tropical Zone the tree is now found throughout Japan.

It is extensively used in building and in making cement casks and for match-sticks and as fuel.

In building the red pine is not equal to *Cryptomeria* and *Chamaecyparis* but its low price causes it to be used instead of *Cryptomeria* for piles. Unpeeled logs are also highly prized as ornamental pillars in the construction of Japanese houses. In Iwate, various utensils are made by bending thin pieces of this wood. The fibre when beaten up is used in making ropes used much by boat men as they are durable in water. The leaves are formed into fibres and made into carpets termed "Murasakiori". Resin is extracted from the wood of this pine, although the yield is not so large as that of the black pine. The tree is successfully planted to solidify sandy soils as well as to make screens. It is also a good ornamental tree and several garden varieties are known among horticulturists. Mushrooms which grow under this pine are also prized as a dainty.

The price in Tokyo is *Yen* 30 per 100 cubic ft.

THUGA SIEBOLDII, CARR.

This conifer is found from the limit of the Sub-tropical Zone to the middle of the Temperate Zone, and is abundant in Kii, Yamashiro, Tōtōmi, Idzu, and Awa.

It is invaluable in house building and in making shingles which last about 40 years. Recently the wood has been much used in paper manufacture. As the wood gives strong heat, it is much used in filature works. The wood being hard and knotty in general, is not easily made into utensils, etc. The bark being rich in tannin is used in dying fish-nets, etc.

The price in Tokyo is *Yen* 35-40 per 100 cubic ft.

ABIES FIRMA THUNB.

This tree is found between the Sub-tropical Zone and the Temperate Zone, especially in Shikoku, Kyūshū, and Kii.

The wood is not suitable for house building. It is used in making ceilings and sliding doors, and various utensils used in

connection with Shintō rites. It is used also for making packing boxes and in paper manufacture.

The price in Tokyo is *Yen* 35-40 per 100 cubic ft.

CHAMAECYPARIS PISIFERA, S. ET Z.

Belonging to the Temperate Zone it is found in the Northern and Central parts of the Main Island according to the altitude. Thus it is often found at the height of 3,000 ft. in the central part of the Main Island. Bungo, Yamato, Iwashiro, Shinano, and Uzen are the principal provinces which it is produced.

Although its texture is very fine, the wood is easily cracked and it is chiefly used in making planks, window-frames, and sprit wood vessels.

The price in Tokyo is *Yen* 40. per 100 cubic ft.

FRAXINUS MANDSHURICA Rupr.

This tree grows in the Temperate Zone more especially in humid districts of Hokkaido, and the northern part of the Main Island. It is used in house and boat building, for railway ties, and in making various farm implements, wooden clogs, utensils, etc.

The price in Tokyo is *Yen* 50 per 100 cubic ft.

ACANTHOPANAX RUCINIFOLIUM S. ET Z.

This tree belonging to the Temperate Zone is found abundantly on the slopes of Mt. Fuji, and in Hokkaidō, where the best wood is produced for railway ties. It is used in turning, and cabinet work, and in making trays, and other utensils, wooden clogs, etc. In ship-building as well as in joinery the wood has no equal. The young leaves are eaten by the mountain people.

The price in Tokyo is *Yen* 60 per 100 cubic ft.

CLADRASTIS AMURENSIS B. ET H. VAR. *FLORIBUNDA* MAX.

This tree grows in the northern part of the Main Island and in the southern part of Hokkaidō, being a native of the Temperate Zone.

As the wood is fine in texture it is used in turning and in cabinet as well as for ornamental pillars. It is also used in making agricultural implements, saddles, etc.; and it is the best wood for

railway ties. The bark furnishes dying material, and is used by the aborigines of Hokkaidō as a remedy for bruises. The tree is beautiful for gardens and avenues.

CASTANEA VULGARIS LAM. VAR. *JAPONICA* DC.

It is found in the Sub-tropical and the Temperate Zones in great abundance, especially in Chikuzen, Iwami, Echigo, Kai, Omi, Iyo, Tosa, Kōdzuke, Shimotsuke, Rikuzen, Rikushū, Mutsu, and southern part of Hokkaidō.

The wood is valuable for foundations, well-cribs, drains, and for other similar purposes where wood is exposed to moisture. Shingles, ladders, oars, piles, etc., made of this wood, last well, being hardly equalled by any other wood and it also makes good railway sleepers. The price in Tokyo of sleepers is about *Yen* 0.75 apiece.

JUGLANS SIEBOLDINA, MAXIM.

This tree grows in the fertile plains of the Temperate Zone. It is abundant in Kōtsuke, Shinano, Tamba, Iwashiro, and the southern part of Hokkaidō.

The wood is invaluable for making rifle stocks. By constant cleaning and polishing, the wood takes a high polish so that it is made into cabinets, tables, chairs, etc. On account of its taking varnish well it is especially suitable in carriage building. It is also used in making clogs and match-sticks. The bark is a good insecticide and from the edible nuts a good table oil is obtained. The hulls of the nuts contain an essential oil, and tannic and citric acids, and are used in dying.

The price in Tokyo is *Yen* 80 per 100 cubic ft.

BOARDS OF IMPORTANT JAPANESE WOODS.

CRYPTOMERIA JAPONICA, DON.

Locality. Yakushima, Satsuma.

Uses. The general characteristics of *Cryptomeria japonica* are given elsewhere. The wood as shown here is specially prized for its beautiful grain and is used in making ceilings, and the ornamental

fittings of Japanese houses. The wood with birds-eye grain is used for screens, doors, and other ornamental articles.

The price in Tokyo is *Yen* 0.70 per square ft.

CRYPTOMERIA JAPONICA DON.

It is dark wood which underwent carbonification by being buried, and is found in Suruga, Sagami, and Ise. The present exhibit is taken from an old tree. The grain is straight, as the organic matter has been perfectly dissolved underground, it is free from resin, etc. The wood is little affected by the moisture and being of a beautiful dark colour, it is extensively used in making valuable furniture and ornaments.

The price in Tokyo is 30 *sen* per square ft.

THUJA JAPONICA, MAXIM.

Locality. Belonging to the Temperate Zone, it is abundantly found in Kiso, Nikko, Rikuchū, Iwashiro, Uzen, Etchū, Kaga, and Tajima, in admixture with *Chamaecyparis obtusa*, *Chamaecyparis pisifera*, and other trees.

Uses. The wood of a slightly dark colour is suitable for cabinet work and for use in ceilings, panels, and other ornamental parts of Japanese houses. It is one of the most beautiful decorative woods.

When made into shingles the wood lasts well.

The price in Tokyo is 10 *sen* per square ft.

GINGKO BILOBA, L.

Locality. This is the only remaining species of a former geological age. Its growth is mostly limited to gardens and the grounds of shrines and temples.

Uses. The wood is made into chess-boards, chess-men, seals, abacus beads, chopping blocks, wash-boards, etc. It is used in making ornamental alcoves and as the ground work of lacquer ware. The leaves are used as a fertilizer, and are at the same time a good insecticide, especially in rice fields under water. Leaves are also used as book-marks to keep off noxious insects. The nuts are eaten either boiled or roasted, and are made into sweet-meats. In

autumn the foliage turns yellow forming a great attraction in gardens and avenues.

The price in Tokyo is *Yen* 70 per 100 cubic ft.

TAXUS CUSPIDATA, S ET Z.

Locality. It is found in Kiso, Nikkō, and Hokkaidō, in the Frigid and Temperate Zones.

Uses. In cabinet work and for canes and small articles, such as cigarette-holders, photograph frames, etc. Being knotty it is but seldom used in the decorations of houses but it is much used in making water-tanks, bath-tubs, pails, etc. When covered with water its characteristic rosy colour lasts for 30 years. Chips of this wood are made into beautiful braid for hats and matting. It is used also in carving as well as in the manufacture of pencils. In Nikkō and Akita, well-known chop-sticks are made of this wood; and in Kuraiyama, Hida, maces used by priests are made. The aborigines of Hokkaidō make their bows of this wood. Combs are made in Kiso and clogs at Chusenji. Old trunks rotten in the centre, are used in making hibachi (fire boxes). The nuts are edible and it is used as an ornamental tree.

The price in Tokyo is *Yen* 100 per 100 cubic ft.

MORUS ALBA L. VAR. *STYLOSA* BUR.

Locality. It grows abundantly in the Northern part of the Main Island and in Hokkaidō, belonging to the Sub-tropical and Temperate Zones.

Uses. The wood is used in cabinet work, for trays, fire-boxes, clocks, etc.; and in making musical instruments such as the samisen (an instrument with three strings), the teikin (a kind of mandolin), etc. It is also used in carving and turning and in making saddles, sledges, etc. It is used for posts and ornamental alcoves in dwelling houses. The aborigines of Hokkaidō make their bows and other primitive weapons of the wood. The bark is used in making hand-made paper. The leaves are, indispensable in sericulture.

The price in Tokyo is *Yen* 100 per 100 cubic ft.

CINNAMOMUM CAMPHORA. NEES.

Locality. The tree grows in the Sub-tropical and the northern half of the Tropical Zone being abundantly found in Shikoku, Kyūshū, and Formosa.

Uses. The wood which was formerly prized in ship-building has lately lost its importance, on account of the use of iron in ship-building. It is used in making the ornamental parts, and the furniture, of large ships being prized for its high polish and beautiful grain. Many Japanese junks and boats are still made of this wood alone. Its chief use, is, however, in cabinet work, such as chests, alcoves, wood-mosaics and in the manufacture of valuable musical instruments. The wood resists the attacks of insects, although unless trees are felled in the proper season the wood is attacked by them.

The most important use of camphor wood is, however, in camphor making, the percentage of this valuable product differs according to the age of the tree and the part used. Thus, in a tree more than 80 years old, the branches give 2.2% of camphor; the boughs, 3.7%; the trunk, 4.2%; the lower end of the trunk, 5.7%. Camphor is now obtained from the leaves too, the percentage varies from 3% to 4%. The red leafed species yields more than the green leafed one. Caterpillars which produce guts are fed with the leaves of the camphor tree. The roots of this tree are very rich in camphor.

From the seeds, vegetable wax is obtained. The wood after being long underground has a darker colour and is termed "Jindaikusu." It is highly valued in making ornaments.

The price in Tokyo is *Yen* 110 per 100 cubic ft.

FRAXINUS MANDSHURICA, RUPE.

Locality. The tree grows in the Temperate Zone especially in the north part of the Main Island and in Hokkaido where it thrives in moist land.

Uses. The wood is used in the house and boat building, in making farm-implements, rifle-stocks, clogs, trays, bowls, and other utensils. It is used for railway sleepers and fuel. Wood with a fancy grain is used in making ornaments. The branches yield wax.

The price in Tokyo is *Yen* 50-100 per 100 cubic ft.

ZELKOWA KEAKI, SIEB.

Locality. This tree is found in the Sub-tropical and Temperate Zones being abundant in Hyuga, Nagato, Kii, Shinano, Totomi, Idzu, and Iwaki.

Uses. The wood is extensively used in ship, carriage, and house building and in making furniture. The wood is used also in the fittings of houses and in the carvings of shrines, temples, etc. in turning and as the ground work of lacquer.

Finely grained wood has special names such as "Quail Grain", "Leopard Grain", "Ring Grain" etc. is highly valued in furniture manufacture and cabinet work.

The ashes of Keyaki are used in porcelain making, being only next in quality to those of *Distylium racemosum* S. et Z. The bark which is easily peeled off is made into flails and fire-boxes; and in Echizen, it is made into tobacco-holders, trays, and other fancy-articles. Edible mushrooms, which are quite palatable when well cooked, grow on the wood.

The price in Tokyo is Yen 180 per 100 cubic ft.

PHELLODENDRON AMURENSE RUPE.

Locality. It grows well in the marshy districts of the Temperate Zone being abundant in Hokkaidō.

Uses. For rifle-stocks, the wood is only second to *Juglans sieboldiana*. It is made into cups, bowls, etc., and is also used in turnery. Fine grained wood is used in furniture manufacture. A yellow pigment is made from the bark. If this is used in the manufacture of Japanese paper it makes it proof against insects so that it is suitable for registers, etc. The bark is used as a substitute for cork and the aborigines of Hokkaidō use it for the roofs and sides of their primitive huts. Fishermen in Siberia, use the bark in making floats for fishing nets. The seeds having a bitter taste are a good insecticide, and are used as a medicine by the country people.

The price in Tokyo is Yen 60 per 100 cubic ft.

AESCULUS TURBINATA BL.

Locality. Belongs to the Temperate Zone and grows in the mountains of Kotsuke, Shimotsuke, and in the northern part of the Main Island.

Uses. In boat and bridge building, furniture making, fittings of houses, utensils, the ground work of lacquer, etc.

Old trees have swellings at the root in sizes up to a foot in diameter and the fancy grain of these is highly valued. The nuts are in making starch, in washing, and in various other way.

The price in Tokyo is *Yen* 60-100 per 100 cubic ft.

ACER PALMATUM. THUMB VAR. MONO MAXIM.

Locality. Belonging to the Temperate Zone it is abundant in Hokkaidō, and the northern part of the Main Island.

Uses. The wood is used in implement, and wagon making, turning, furniture, wood-mosaics, rifle-stocks, etc.

The price in Tokyo is *Yen* 80 per 100 cubic ft.

PRUNUS PSEUDO-CERASUS LINDL. VAR. SPONTANEA MAXIM.

Locality. Belonging to the Temperate Zone, it is abundant throughout Japan, and grows best in dry sunny places.

Uses. In cabinet work and furniture making, in carving and turning, in making lacquered ware, ornamental posts, scientific instruments, utensils, spinning wheels, etc.

The green wood is very easily warped, so it is generally buried to season it. The bark is strong and is made into fancy articles. The aborigines of Hokkaido use it in joining the parts of their primitive canoes, and in decorating their bows, quivers, and other weapons. They use it as an antidote against the poison of certain fish.

The price in Tokyo is *Yen* 70 per 100 cubic ft.

PAULOWNIA IMPERIALIS S. ET Z.

Locality. This tree thrives in the plains of the Temperate and Sub-tropical Zones, being abundant in Mutsu, Kotsuke and Shimotsuke.

Uses. In making musical instruments. The "Koto" (a thirteen stringed instrument) is exclusively made of this wood. The wood being very light, it is used in making small boxes for various uses, book-cases, clogs, and floats for nets. The old wood, which is more compact and fine grained than the young wood is specially known as striped "Kiri" wood. Charcoal made of this wood is used as a polish-

er. In a pulverized form it is indispensable in the manufacture of gun-powder.

The price in Tokyo is *Yen* 0.40 per square ft.

DIOSPYROS KAKI L. F.

Locality. It grows in the Temperate Zone and is abundant in Mino, Shinano, Kazusa. The heartwood, which is of deep black colour, is termed "Black Kaki Wood," while that part which is not perfectly black, is termed "Striped Kaki Wood." It is used as ornamental wood in joinery and house building, and in making high-priced furniture such as valuable desks, cases etc., corresponding in its use to ebony and mahogany. Being the only black wood known in Japan, it is indispensable in wood mosaics for that colour. A liquid rich in tannin obtained from the unripe fruit of the "Kaki" is used in painting paper, cloth, wood etc., serving at the same time as an antiseptic.

The price in Tokyo is *Yen* 160 per 100 cubic ft.

FAGUS SYLVATICA L. VAR. SIEBOLDI MAXIM.

Locality :- Belonging to the Temperate Zone it is very abundant in Iwate, Aomori, Amagi, Hitachi, Nikko, Chichibu as well as in the mountains of the Main Island, Shikoku, and Kyūshū.

Uses. The wood is used in making boats, ploughs, handles of tools, rifle stocks, clogs, spinning wheels, lacquer ware, and various utensils. The bark is used in dying nets. The seeds are edible when roasted and are much used by the people of the mountains when food is scarce. Oil from the seeds is used for lighting as well as for food. The demand for this wood has greatly increased lately because when it has been treated with preservatives it is especially suitable for sleepers and foundations.

The price in Tokyo is *Yen* 25 per 100 cubic ft.

MELIA JAPONICA DON.

Locality. The tree grows abundantly in Tosa and Osumi, in the Sub-tropical Zone.

Uses. For making house decorations the wood is highly prized. It is also used in making furniture and utensils. The wood is not subject to attack by insects. The leaves are used for fertilizer; and in the form of powder, they furnish an insecticide

for use on growing tobacco and rice. A decoction of leaves is equally effective when sprayed over plants.

The price in Tokyo is *Yen* 100 per 100 cubic ft.

QUERCUS ACUTA, THUNB.

Locality. This tree, belonging to the sub-tropical zone, grows throughout Shikoku, and Kyushu as well as in Kii in great abundance.

Uses. Being very strong, the wood is used in making carriages and machines. In the manufacture of farm implements where durability and strength are required, the wood is invaluable.

The price in Tokyo is *Yen* 70 per 100 cubic ft.

QUERCUS CRISPULA BL.

Locality. This deciduous oak grows in the plains and in low lands being found both in the Temperate and Frigid Zones. Chiehibu, Shimotsuke, Kotsuke, Uzen, Mutsu, and Hokkaido, are the principal places of production.

Uses. As fuel it is surpassed only by *Q. serrata*, Thunb. and it is one of the most important forest trees. The wood from old trees gives little smoke and burns steadily. Charcoal obtained from younger trees is used in smelting. Ashes of the leaves are used in dyeing. The wood is used in making chairs, beer and wine barrels, mortars, and for sleepers. The bark yields an extract used in dyeing. Mushrooms are grown on the decaying wood.

The price in Tokyo is *Yen* 50 per 100 cubic ft.

CINNAMOMUM PEDUNCULATUM NEES.

Locality. Belonging to the Sub-tropical Zone and the edge of the Tropical Zone it is found in Shikoku, Kyushu, Okinawa, Formosa, Idzu, and Awa; there are two species, red and white.

Uses. The wood is used in making implements in carving, and for foundations and sleepers. In the Island of Hachijo small canoes are made of this wood. The well-known Hachijo silk is dyed by an extract from this wood. When the tree is planted as borders for conifers, it screens them well protecting from the wind and keeping moisture in the ground.

The price in Tokyo is *Yen* 55 per 100 cubic ft.

MAGNOLIA HYPOLEUCA S. et Z.

Locality. This tree thrives well in soils rich in moisture, both in the temperate and frigid zones. It grows naturally in abundance in Yamato, Tamba, Mimasaka, Shinano, Shimotsuke, Iwashiro, Mutsu, and Hokkaido.

Uses. Being soft and uniform in texture, it is suitable for making boards for sketching, cutting, and chopping, for the ground-work of the lacquer ware, known as "Aidzu lacquer", and for making musical instruments, seals, turned and carved articles utensils, looms, umbrella handles, match-sticks, and the furnishing of junks. Charcoal made of this wood is prized for polishing lacquer ware as well as for finishing cutlery. On account of its luxuriant foliage is used in gardens and avenues.

The price in Tokyo is *Yen* 70 per 100 cubic ft.

CERCIDIPHYLLUM JAPONICUM S. ET Z.

Locality. The tree grows in the temperate zone, being abundantly found in Shinano, Shimotsuke, the northern part of Main Island and Hokkaido.

Uses. The wood is used for house, bridge and ship-building, and in making sketching, cutting, and chess boards, furniture, and for wood engraving.

The price in Tokyo is *Yen* 40 per 100 cubic ft.

QUERCUS CUSPIDATA THUNB.

Locality. Growing in the sub-tropical zone, it is common in various forests in Hyuga, Osumi, Satsuma, Tosa and Kii, mixed with other oaks.

Uses. Originally this tree was mostly used for fuel. Owing to the recent progress in impregnating wood with preservatives, the wood is now extensively used for sleepers. It is likewise used for cross arms of telegraph poles, cement-barrels, sugar-barrels, etc. As there is an immense supply of these trees which are generally found in localities with every facility for transportation, the production will probably be greatly increased.

The price is *Yen* 0.35 apiece for sleepers at Kobe.

GROUP 661.

CAMPHOR AND ITS BY-PRODUCTS.

DISTRIBUTION OF CAMPHOR TREES.—The growth of this important tree is limited in this country to the south of 36° N. L. On the south coast of the Main Island, Shikoku, and Kyushu the trees are met with only in the compounds of shrines and temples or in gardens, where they have been preserved from felling. As the distillation of camphor became common, the felling of the trees increased, and forests of this valuable tree were greatly reduced in area, but a few old specimens were fortunately preserved. The propagation of this tree is in no way neglected so that the production of camphor will increase in the course of years. Formosa, has at present an extensive supply of these trees, as there huge trees are still found in their primordial luxuriance, in districts not yet explored.

CAMPHOR TREE PLANTING.—In raising camphor trees, seedlings are obtained by sowing the seeds directly in a wood. Small holes are dug in an already well grown forest of evergreen oaks or red pines, and four or five seeds are put in each hole. The shelter of the trees favors the growth of the seedlings.

In fifty years they will attain a diameter of 1 ft. when they are large enough for the production of camphor. In many places, attempts have been made to grow the tree by transplantation, but without success. In other places in order to obtain leaves to produce camphor the so-called "coppice-planting" is effected and it will be of advantage to this industry.

CHEMICAL PROPERTIES OF CAMPHOR.—Every part of a camphor tree contains camphor which is obtained by distillation.

Camphor is a white semi-transparent amorphous substance with a specific gravity of 0.987, and with a peculiar smell. When it is tasted it gives a sharp taste turning into a cool one. When plunged into water it forms circles and when lighted it burns, floating on water. It is almost insoluble in water, but readily dissolves in alcohol, ether, acetone, chloroform, acid, and volatile oil.

Camphor is found as crystals in the tissue of the wood and by double distillation is separated from the crude oil which is the first distillation product. It is an oxidized product of Camphorgenotol which forms the principle of the camphor oils of commerce.

CRUDE CAMPHOR.—This substance is obtained as crystals by the distillation of camphor chips, or camphor leaves in the presence of water vapour, it is separated as such after sufficient distillation, and subsequent liberation of water and oil. It is a dark coloured substance and fuses at 170°C .

CRUDE CAMPHOR OIL.—The substance is obtained as a liquid in the separation of camphor, with which it comes out simultaneously. Camphor and other by-products are afterward separated from this substance.

WHITE OIL.—This is a white oil, with a specific gravity of 0.88 at 15°C ., obtained by sublimating crude camphor oil. It distils below 188°C . and is used in soap-making, etc.

RED OIL.—This substance, like white oil, is obtained from crude camphor oil. It has a sp. g. of 1.020 at 15°C ., and fuses at 170°C .

BLACK OIL.—This substance also is obtained from crude camphor oil. It is a black liquid having a sp. g. of 1.007 at 15°C .; it is extensively used in varnishing substances.

TURPENTINE.—Like varnish, this substance is obtained from white oil and is extensively used for medical and industrial purposes.

SUFFROL.—This is a colourless transparent substance obtained from red oil. It has a sp. g. of 1.108 at 15°C . It fuses at 225°C . It is extensively used in making perfumery and soap.

DISINFECTOR.—This substance was discovered by Dr. Shimoyama Junichiro in 1901. It is obtained by the partial distillation of red oil with which a few ingredients have been mixed. It is a brownish heavy liquid having a sp. g. of 1.032 at 15°C ., with very strong antiseptic properties. A solution of 1 part in 100 of water easily kills the cholera bacillus, and the pest bacillus. The price in Kobe is Yen 0.35 per lb.

INSECTOR.—This substance also was discovered by Dr. Shimoyama Junichiro, and is obtained by a process similar to that used in obtaining "disinfector". It has a sp. g. of 0.987 at 15°C .; mix-

ed with water, it presents a milky white appearance and is strongly antiseptic. A solution in 100 parts of water is efficient in killing insects injurious to various farm crops. The price in Kobe is *Yen* 0.25 per lb.

REFINED GRANULAR CAMPHOR.—This is a product of sublimation of crude camphor. It fuses at 174°. The price in Tokyo is *Yen* 0.85 per lb.

REFINED CAMPHOR.—This substance is the refined product of ordinary crude granular camphor, by sublimation and subsequent compression. It fuses at 175°C. and costs *Yen* 1.00 per lb. in Tokyo.

REFINED CAMPHOR TABLETS (Fujisawa Camphor).—This form is obtained by the distillation of crude camphor under suitable pressure. The price in Tokyo is *Yen* 1.70 per lb.

By the provision of the Law of the 36th year of Meiji (1903) the sale of camphor produced in Japan, is monopolized by the Government, by means of restricting the sale of crude camphor and camphor oil.

The annual production of camphor in Japan is 6,000,000 lb. and it is exported in great quantities. 1,500,000 lbs. is produced in the Main Island, Kyushu, and Shikoku and, the remaining 4,500,000 lbs. in Formosa. The photographs shown will give some idea of the appearance of camphor trees.

No. 1, 2. View of a Camphor Forest, in the State Forest of Miyagawa, Osumi.

No. 3. A Camphor Tree in the State Forest of Mt. Tachibana, Chikuzen.

No. 4. View of the State Forest of Camphor Trees at Mt. Tachibana, Chikuzen.

No. 5, 6. Camphor Tree Nurseries in the State Forests in Osumi and Terakura.



GROUP 662.

CHIPS AND CHIP-BRAID.

The first shipment of chips ever made from this country to a foreign market was in 1894. It did not show any increase till 1899 when considerable business was done. Since then constant progress has been made, and the exports for 1903 amounted to Yen 177,000 for chips and Yen 1,246,000 for chip-braids, aggregating Yen 1,363,000.

The chips are mostly made into chip-braids to be worked into hats, but they are also woven into floor matting. They must very strong and soft in nature. The following trees are mostly used for making chips.

Pomulus trepula L. var. *villosa*. Wesm :—This tree is found in the upper half of the temperate zone. It grows everywhere in the Main Island, and in the highlands of Shikoku and Kyushu, thriving in the soft soil rich in moisture found in Rikuchu and Hokkaidō. It grows very rapidly in a cold climate and often attains the height of 120 ft. and the diameter of 3 ft. Some trees 20-30 years old are 60 ft. high and 1 ft. in diameter. The wood is soft in texture and white in colour with a peculiar lustre, and is exceedingly suitable for making into chips, as both heart and sap-wood are the same in colour. The wood is also made into match sticks. The tree is propagated either by slipping or by cutting.

2. *Acanthepanax riciinfolium* S. et Z. :—This tree belonging to the temperate zone is found abundantly in the northern part of the Main Island and in Hokkaido. The method of propagating this tree has not yet been discovered, but it grows luxuriantly in Ishikari, Tokachi, and Iburi, mixed with *Fraxinus mandshurica* Rupr. and *Cladrastis amurensis* B. et H. var. *floribunda* Max. It covers large areas of low moist soil, and is of relatively rapid growth.

Being compact and reddish brown in color the wood makes rich glossy chips termed "chijimi" or "crépe", and "shigoki" or "crisped".

Cercidiphyllum japonicum S. et Z. :—The tree thrives well in

the temperate zone especially where there is plenty of moisture, as in the plains of Hokkaido and Mutsu. It is mixed with *Fagus Sylvatica* var. *Sieboldii*, Max. *Quercus crispula* Bl., and *Fraxinus Mandshurica* Rupr. As the wood is strong and compact in texture, and light brown in colour, it is highly suitable for making chips, such as "kasumi" or "curled" and "chijimi" or "crépe".

Aesculus turbinata Bl. :—This tree of the temperate zone is abundantly found in Kii, Kotsuke, and Shimotsuke as well as in the northern part of the Main Island.

The wood which is compact and glossy, especially near its root end when old, is highly prized for its grain and affords the best material for chips. Although its use as chips is of recent date, yet their value has caused an increased demand for this wood. Chips of this wood are now plaited in different forms being very much used, either plain or coloured.

Thanks to the strict restriction of the felling of this tree under the feudal régime, the timber stand is still large together with *Abies firma* Thunb., *Thuja Sieboldii* Carr., and *Acanthepanax ricinifolium* S. et Z.

Paulownia imperialis S. et Z. :—The tree is found in the plains of the sub-tropical and temperate zones. Most of the trees are cultivated and it is very scarce in the mountains. It grows very rapidly to the height of 50 ft. and the diameter of 10 inches within ten years.

The wood, which is very soft, and hollow at the centre is mostly straight grained and homogeneous. It is much used in joinery as well as in the making of chips.

Prunus, pseudo-cerasus. Lindl. var spontanea, Max. :—This tree of the temperate zone is extensively found throughout the Main Island and Hokkaidō. It grows wild in the mountains of these regions, but seldom alone.

The wood, which is hard and of a lovely rose colour, is extensively used for various purposes. It is harder to work than other woods but is highly valued for its quality.

Magnolia hypoleuca. S. et Z. :—The tree thrives both in the temperate and the frigid zones being very common in marshy soils. It is abundantly found in Yamato, Tamba, Mino, Shinano, Shimotsuke, Mutsu, and Hokkaidō. It forms flourishing forests with

Cercidiphyllum japonicum, s. et Z., and *Fagus sylvatica* L. var. *Sieboldii* Max, attaining considerable size.

The wood is grayish white and is very homogeneous in texture.

Pterocarya rhoifolia S. et Z.:—This tree belonging to the temperate zone is found between the central part of the Main Island and the southern half of Hokkaidō. It is seldom met with in mountains, being mostly limited to marshes and valleys especially in Kiso, Chichibu, and Mutsu.

It grows very rapidly and attains the height of 30 ft. and the diameter of 3 ft. in 40 years. The largest trees are 60–70 ft. high and 4 ft. in diameter. It is a deciduous tree with a smooth white bark.

The wood which is soft is perfectly homogenous having no distinction between heart-wood and sap-wood. It is used in making match-sticks and chips. At present, there are only trees of natural growth, and the timber stand is still large. In future the supply will doubtless be increased by planting.

Picea ajanensis Fisch.:—The tree belonging to the frigid zone is a typical tree of Hokkaido. It grows very slowly and the wood is of a light rose colour and finely grained. The wood is soft and light; its use in making chips is quite extensive, it being very similar in this respect to *Thujopsis dolabrata* S. et Z. In Ishikari, Kitami, Kunashiri, Nemuro, and Shiribeshi, it covers most of the forest area, in immense quantities. The State Forests of Shari, Kitami, Kushiro, Crown Forest in Kushiro are the best examples of forests of this tree.

Chamaecyparis obtusa, S. et Z.:—This tree of the temperate zone is most extensively found in the Main Island, Shikoku, and Kyushu, especially in Kiso, Kii, Musashi, and Tōtōmi. Where the soil is well supplied with moisture, the tree grows remarkably well either alone or mixed with other trees.

The wood which is of a light rose colour is tough and hard, possessing a characteristic smell. Chips made of this wood are undoubtedly among the most beautiful specimens obtainable. The wood is finely shaded and is soft in texture.

CHIP INDUSTRY.

In conclusion we may say a few words regarding this new Chip Industry. As we have seen the forest trees of the Temperate Zone are by far the most important as nearly the whole of the Main Island and Hokkaido is included in this zone. Most of the trees affording the materials for chips are produced in this zone.

In measuring wood used in the chip industry the unit is 10 cubic ft. weighing 75 catties in the case of *Chamaecyparis obtusa*; 52-83 catties in the case of *Populus tremula*; and 93 catties in the case of *Magnolia hypoleuca*.

CHIPS.

The chips are made by planing wood with a proper tool, producing chips of the requisite size. The planes used greatly differ in type as well as in size. In general, chips are 15 inches long, and 1.6 inches wide. The chips are of various kinds such as "Chijimi" (crêpe); "Usuehijimi" (thin crêpe); "Shina-chijimi" (striped crêpe); "Urukochijimi" (scaly crêpe); "Iikitsukechijimi" (crimped crêpe); "Amiehijimi" (net-work crêpe); "Chisujiechijimi" (veined crêpe); "Sukogi" (pulled); "Noshi" (pushed); "Uki-moyokatatsuki" (relief figured); "Hadōkatatsuki" (undulated), etc.

Some chips are dyed and readily take up pigments. At present, there are more than 120 manufactories in the Empire; two thirds of them being located in the northern part of the Main Island and in Hokkaido, while the rest are scattered in the southern part of the Main Island and in Shikoku.

The annual production is 2,000,000 catties with an average value of Yen 10-20 per 100 catties in Tokyo. Chip-braids are exported in large quantities to foreign markets. The demand for braid abroad is increasing while that for chips is decreasing. The export of chips was valued at Yen 117,000 in 1903, against Yen 378,000 for 1902. The exports are mostly to Italy, France, England, and China.

CHIP-BRAID.

Chip-braid is made by plaiting chips alone or with other materials. Fancy braid is made by plaiting chips with silk, or

silky materials. Generally it is exported in bundles of 15-60 yards with the breadth of 1.2-1.6 inches. The centres of the chip industry are Hiroshima, Okayama, Wakayama, Kanagawa, and Tokyo.

The annual production exceeds 3,000,000 bundles valued at Yen 1,500,000. The price in Tokyo is Yen 0.50 per bundle on an average, but some of the choicest specimens are worth Yen 3.00. The total value of exports of this article in 1902 was Yen 1,246,590. The destination is chiefly the United States and England.

CHIP BRAID BONNETS.

The present assortment of chip braid Bonnets was manufactured by Mr. Koyama Zentaro, who has been connected with the Department of Agriculture and Commerce in connection with this industry.

None of the bonnets shown here had been made in Japan until he succeeded in producing many kinds and shapes as shown in the collection.

No. 1 is made of pushed chips of *Populus tremula* mixed with striped chips of *Picea ajanensis* interwoven with ordinary crêpe chip.

No. 2 is made of pushed chips of *Populus tremula* and crêpe silk. This shape is called "Fuji" or conical.

No. 3 is made of pushed chips of *Populus tremula* interwoven with the leopard chips, into the fringed ball shape.

No. 4 is made of pushed chips of *Populus tremula* interwoven with silk lace and is made into a conical shape.

No. 5 is made of chips of *Picea ajanensis* with twisted chips of *Chamaecyparis obtusa* and is made into the "oval," shape.

No. 6 is made of crêpe chips *Populus Gemula* interwoven with silk is imitation of a butterfly.

No. 7 of the same material but of the shape of a flower bouquet.

The above collection will give an adequate idea of the light and elegant forms of ladies head-wear. The artificial flowers are also made of chips, in imitation of wild flowers of Japan.

STAVES AND BARRELS.

The exhibits were made at the Stave Works of Ohtsuka Enjiro of Tokyo, of the wood of the *Quercus grosseserrata* Bl. obtained in

Hokkaidō. The wood used in these exhibits was taken from a tree 150 years old 91 ft. high and 3.2 ft. in diameter. It was felled in November, and was made into staves showing well the grain and the medullary rays.

1. Storage Barrel :—Capacity 80 hectolitres. Diameter of ends 7.2 ft. Diameter of centre 8.35 ft. Height 8.35 ft.
Staves $8.35 \times 0.65 \times 0.28$ ft. Bottom pieces $7.2 \times 0.65 \times 0.3$ ft. Man-hole pieces $7.2 \times 1.2 \times 0.3$ ft.
2. Fermentation Tub :—Capacity 40 hectolitres. Diameter of ends 5.85 ft. Diameter of Bottom 6.5 ft. Height 5.8 ft.
3. Transportation Barrel :—Capacity 1 hectolitre. Diameter of Ends 1.65 ft. Diameter of centre 2.0 ft. Height, 2.3 ft.
Staves, $2.3 \times 0.4 \times 0.15$ ft. Bottom pieces $1.65 \times 0.4 \times 0.13$ ft.
4. Transportation Tub :—Capacity 50 litres. Diameter of ends 1.35 ft. Diameter of Centre 1.65 ft. Height 1.9 ft.
Staves $1.9 \times 0.3 \times 0.15$ ft. Bottom pieces $1.35 \times 0.3 \times 0.12$ ft.
5. Transportation Tub :—Capacity 25 litres. Diameter of Ends 1.07 ft. Diameter of centre 1.29 ft. Height 1.45 ft.
Staves $1.49 \times 0.3 \times 0.14$ ft. Bottom pieces $1.07 \times 0.3 \times 0.1$ ft.

Quercus grosse-erata which belongs to the temperate zone is found all over the mountains districts of the Main Island when *Fagus Sylvatica* is the representative type, and is abundant in Shimotsuke, Uzen, Rikuchu, Mutsu, Iburi, Ishikari, and Tokachi. In Hokkaidō it grows chiefly in the plains.

This wood is used in making almost all the barrels, tubs, etc. used in the production and transportation of beer, wine and alcohol.

The price in Tokyo for materials for barrels is :—

Capacity	Price	Capacity	Price
80 hectolitres	Yen 180	50 litres	Yen 6
40 "	" 65	25 "	" 5
1 "	" 9		

GROUP 665.

GALLS.

LOCALITY OF PRODUCTION NISHIMUROGORI, WAKAYAMA.

The *Ithus* tree (*I'ushinoki*) on which gall-insects live grows in the temperate and sub-tropical zones. Galls are produced chiefly in Wakayama, Ehime, and Kōchi; and in smaller quantities in Yamaguchi, Shinano, Tottori, Gifu, Miye, and Oita.

Japanese galls are of two kinds. The kind termed "Mimibushi" resembles very much the waterchestnut in form, though it is somewhat larger. It is divided into three or four distinct lobes. They are hollow but heavier and thicker than the galls of the other kind. They are also richer in tannin, and consequently fetch a higher price. After metamorphosis, the insects leave the galls when they greatly depreciate in quality.

The other kind termed "Hanabushi" have more lobes, resembling the sea algae. As the lobes are very thin and light, they are very poor in tannin.

PREPARATION. At the end of September, galls attain their full size. Two weeks later the insects get their wings and begin to bore small holes in the galls to escape. This causes a great decrease in the amount of tannin. Care, therefore, must be taken to collect the galls before this begins, and to expose them directly to the sun to kill the insects. Galls offered for sale are distinguished as "white" and "black." "White galls," have been only dried in the sun while "black galls" have been put in hot water to kill the insects. Hot water dissolves a larger quantity of tannin and this method of killing the insects is, therefore, objectionable. The different methods are now the subject of investigation.

USES. Galls contain 50-67 % of tannic acid. They are crushed into small grains, and exposed to steam. Tannic acid, thus obtained, gives a brownish colour, and is extensively used in dying cotton in making a black dye in conjunction with iron compounds, and as a morant. It is also used in tanning and in the preparation of ink, and medicine.

EXPORT OF GALLS. The first exports were made in 1880, when some were shipped to France as materials for colouring. Subsequent shipments were made to Germany, China, and other countries, with a gradual increase both in value and quantity. The following table shows the quantities and value :—

Year	Quantity in catties	Value in Yen
1888	303.265	49.331
1893	334.035	55.451
1898	541.558	122.239
1900	1,158.791	306.396
1901	158.154	41.853
1902	246.473	58.433

The great decrease in 1901 and 1902 was due to the fall of the price of this article in the German market causing a considerable reimportation of the article to this country. Fortunately, at present, the domestic market is firm, and there is hope of maintaining the price.

Japanese gall insects are produced exclusively on the Rhus tree. (*Rhus semialata* Murz var. *Osbecki* De.) They are perfectly distinct from the insects produced on oak trees in Europe. The insect of "*Mimibushi*" is an aphid termed *Schlechtendalia chinensis* J. Bell (aphid chinensis.) These insects lay their eggs on the narrow pinnate leaves near the leaflets found on the petiole. At the end of May the small knobs, thus formed by the insects began to swell and to form lobes. The adult is a small plump insect. Its head and thorax are dark blue, and it has a light grayish abdomen. The head is broad with black compound eyes. Long antennae which are half the length of the entire body are divided into five segments. The first and second segments are short; the third very long; the fourth about half as long as the third, and the fifth long with two protuberances at the end. The third and the fifth segments are furnished with hairs. The prothorax is rectangular in form, having the same breadth as the head; the mesothorax is somewhat larger, and is plump while the metathorax is by far the smallest of the three divisions. The four transparent maxillipedes of light green are provided with small claws and with marginal spots which are deep gray. The fore wings have single veins while the hind wings are furnished with oblique veins, while the hind wings are furnished with two oblique

veins, and three claws on their anterior edges. The legs are small, the hind legs being long ending with two claws. The abdomen is oblong in shape with elongated ends of a light greenish grey colour; this colour is due to greenish germs it contains. The body is 1 cm. long and the wings from tip to tip measure 6 cm.

In October the full grown insects leave the galls by boring small holes in them. The abdomen of this insect is filled with some scores of eggs, some of which contain a well developed larvæ of a green colour. All the imago that come out from the galls are females, no male insects being known. One female has 20-30 eggs, which are oblong in form measuring 0.33×0.17 mm. The female does not lay eggs but larvæ; the viviform larvæ, are oblong flattened creatures of a light blue colour with black eyes, gray antennæ and maxillipedes measuring 0.352×0.198 mm. Their mandibles are elongated and terminate in the hind legs, and the body is covered with powder. Although the development of the larvæ is not yet fully studied, it is very likely that they lie dormant in winter in cracks in the bark. In spring, they undergo successive metamorphoses till they find the new leaflets of the Rhus tree on which they began to form galls. The galls thus formed are in their first stage, only small balls, which after constant swelling attain their full size in October-November with several distinct lobes of a greenish colour which are soon turned yellow and afterwards purplish red. In this stage, the apex of the gall begins to crack, and the winged female imago go out, after which galls again become a greenish yellow colour, while the texture becomes brittle. After September the galls thus cracked are still filled with several moldings, larvæ, and winged females. The larvæ of a light yellow colour measure 0.608×0.397 mm. and are oblong in form. The head is semi-spherical with black compound eyes. The antennæ are somewhat long, consisting of five segments. On both sides of the thorax there are smaller protuberances. A somewhat developed larva measures 1.026 mm. $\times$ 0.722 mm. being greenish brown with well developed protuberances. On the dorsal side of the thorax and abdomen there are several rows of holes which secrete a white powder. The matured larva attains the size of 1.766×0.798 mm. The head is semi-spherical and green. Between the compound eyes two small circular spots are seen. The thorax is light yellow, and at the anterior edge

of the mesothorax, there are green lines. The wings are well developed in this stage and are well attached to the sides of the body. The abdomen is plump and oblong and is yellowish gray on its sides, on account of greenish eggs contained therein.

THE RHUS TREE. This tree grows well in the temperate and sub-tropical zones in Japan and thrives well in poor mountainous districts. As it thrives everywhere, the first tree that springs up after the ground has been burnt over is the Rhus tree. Its seeds are very much like the beans of *Rhus succedanea* L., the wax-tree of Japan. Galls are produced best on ground with a northern exposure. Southern and western exposures are also suitable but an eastern exposure is not. The reasons for this have not yet been fully investigated.

Rhus trees at present grow wild with hardly any care as to the success of the crop of galls, gall-production being only a secondary industry among farmers and woodmen. The production might probably be greatly increased by attempts to increase the number of insects either by attracting females, by leaving galls containing females in suitable plantations of Rhus trees.

CLASS 120.

GROUP 721.

WILD DUCK FOWLING.

Fowling, is, one of the most aristocratic out-door pastimes and the sport as practised in a preserve is highly developed in Japan. The Wild Duck Preserve of Shinhama belonging to the Imperial Household is located within the Imperial Domain of Higashi Katsushika, Shimōsa, and covers an area of 30 acres. It is well provided with accommodations for the sporting staff, an office for the curator, a pond, wild duck houses, a falconery and a decoy house. The preserve is visited by high dignitaries and foreign guests during the fowling season.

A map of the Preserve, stuffed ducks and hawks, the appliances for fowling, and photographs of the spot are here exhibited.

The sport was, in former days, practiced by the feudal lords. It is now slightly modified as the use of nets is an important part of the fowling, which was done wholly by hawks in former times. The use of hawks is now only to catch the birds which have escaped from the nets. The catch of one day often amounts to several hundreds, and several tens of thousands for the whole season.

The object of the sport is to allure wild ducks into "decoy canals" by means of decoy-ducks. The fowlers there try to take them by the use of nets. Ducks that have not been caught in the net are caught by hawks, so that the frightened creatures shall not return to their flock to disturb the others.

1. ARRANGEMENT OF THE PRESERVE.

1. PROTECTIVE EMBANKMENTS, "JINKIDOME."

These embankments are at some distance from the banks of the pond and are of earth being more than 12 ft. in height, and 6-9 ft. in breadth at the top. Both the top and slopes are planted with evergreen shrubs and bamboos.

The object of these embankment is to shut off the scent of the fowlers and their voices, so as not to frighten game birds from the pond and decoy canals.

2. FOWLING EMBANKMENTS, "MOGORIDOTE."

These also are of earthwork, and are built parallel to the decoy canals at a distance of 24 ft. from them. One end is 12 ft. distant from the embankment of a small ambush, or "watch point," and the other is connected with the embankment. This junction ought to be square and not curved as in this map. The height is about 9 ft. and the sides and tops are covered with evergreen shrubs and bamboos.

In former days, when the use of hawks was more common in fowling, the fowling embankments, served to check the startled games in flying off, and enabled the hawks to dart on their prey. The present embankments, as they stand, are much higher than they were formerly when they were mere mounds with a few scattered

bamboos on their tops. As the result of the change in fowling caused by the use of nets, the "fowling embankments" are now regular embankments, and participating more of the nature of "screens" to separate the different decoy canals.

3. SMALL AMBUSHES OR WATCH POINTS, "KONZOZOKI"

They are situated on the decoy-canals, 24-30 ft. distant from the "Protective embankment."

They are wooden or brick sheds, very much like sentry-boxes, being 6 ft. long and 3 ft. wide. The back of the shed is at the end of the canal and is closed in as are also the two ends. The front is left open. In the back of the shed are very small holes through which grains of millet are dropped into a feeding trough which slopes down into the decoy canal as a bait to the birds.

From these sheds the wild ducks that follow decoys to the decoy-canals, are watched and at times they are fed.

4. DECOY CANALS "AIKIBORI."

(The number of the canals differs according to the size of the pond).

These canals which vary in number with the size of the pond, start from the pond in a curved form, or "Neck," and extend to the "Watch Points." These canals are 6 ft. wide and 4 ft. deep, but the water is only 1 ft. deep. From the "Watch Point" to the "Neck" the canal measures 42 ft. or 36 ft. according as four fowlers or three are in the charge of the sport at these points. The banks of the canals are built of stone preferably, or of stakes driven perpendicularly. The upper edge of the canal has a low embankment 1.7 ft. high and 2.5 ft. broad on the top, covered with turf. The edges of the embankment are marked at different points as the stations for fowlers. Bait is thrown into the canals through the feeding troughs from the "Watch Points." Thus, both decoy and wild birds are accustomed to frequent the canals. One of the party stands in each "Watch Point." As soon as he finds that a sufficient number of wild ducks are following the decoys he will order the rest of his party to join into the sport by drawing nets along the bank of the decoy-canals and the startled birds are caught thus in the nets.

5. NECKS, "NODOGUCHI."

The neck is the crooked part of the decoy canal connecting it with the pond. If the decoy canal were straight the wild birds, seeing the decoys feeding in the canal, would be more readily attracted; but, on the other hand, the wild ducks that are still in the pond would be frightened by seeing others caught on the bank of the canal and would at once fly away. For this reason the entrance to the canal is by the crooked neck. The neck gradually decreases in breadth as it approaches the straight part of the canal which is of uniform breadth.

6. WATCH STAND, "ŌNOZOKI."

One or two principal ambushes, or "Watch Stands" are required for each side of the pond according to its size. In the pond shown in the plan, one ambush suffices for each side. They are generally placed on projecting and elevated points near the centre of the pond so as to command a view of the whole surface. The shed, like that of a "Watch Point" is built of wood or brick, with the interior dark. It is about 7-8 ft. high 6 ft. breadth and 6 ft. long, and is open only at the side away from the pond. The birds are observed through a horizontal slit 5 inches long and $\frac{1}{4}$ inch wide in the front side at the height of a man's eyes. At the lower part of the same side there is a spout, extending into the pond, through which the decoys and the wild birds are fed.

At both ends the shed is closely connected with the embankment. One man from this shed watches over the pond to observe the flock of ducks and to give bait to the decoys and wild ducks unobserved.

7. POND, "TAMEIKE."

The pond is the principal part of the preserve and is generally oblong the direction being determined by the winds that prevail during the fowling-season. Thus, in districts, where north or south winds prevail, it must be elongated east and west. This is quite an important consideration to be borne in mind in the construction of a preserve, since where a south wind prevails, canals placed to the south side of the pond are quite useless in fowling, as wild ducks are quite sensitive to sounds and scent carried to them by the

wind. The oblong shape is chosen because it allows of the greatest number of canals on two sides for the same area of water. The canals are preferably on two sides only, because in this way a greater concentration of the flock is possible than in the so-called "Amida-ike" which has canals on all four sides. The most convenient size of a pond is 2.5-3 acres with the depth of 3 ft. The banks are constructed of stone or brick upon which is raised an embankment 12 ft. high with wide top and sides. This embankment, like the "Protective Embankment" must be planted with shrubs and bamboos. If the pond is provided with a spring in itself only the outlet needs to be constructed of earthenware pipes. If necessary an inflow is also made of pipes. The pond serves to allure wild ducks by the use of decoy birds, forming a resort for them during the fowling season.

8 ISLETS, "NAKASHIMA."

According to the size of the pond, one or two islets are provided as shown in the annexed plan. In a large pond one islet is situated in the centre of the pond, with two smaller ones at suitable distances.

An islet generally about 60 ft. square and is of the same level as the ground about the pond. It is furnished with two accesses, and is planted with shrubs. It forms resting place for the decoys and the wild birds.

9 DECOYS, "OTORI."

Domesticated ducks are used for this purpose. They number one or two hundred according to the size of the pond. Young ducks are kept in the pond from the end of August every year, and are accustomed to take their food from the large and small ambushes, as well as to pass into the decoy canals, previous to the arrival of wild ducks. In this way, wild ducks are easily enticed to follow the decoys into the canals. When the season is over, the decoy ducks are removed, and are replaced by a fresh flock of tamed ducks the next season. Where there is liability of damage by otters the decoys are kept in a shed at night and let out in the day time.

II. FOWLING.

1. The wild ducks that flock to the pond, take it as their resting place. They go at night in search of food to the neighbouring rice-fields, coming back to the pond in the early morning. In the moonlight, they spend most of the night in rice fields gorging themselves with food. They are, then, not easily enticed by decoys. On dark nights, they are but poorly fed and are consequently more likely to follow the decoys on the following mornings.

The best time for fowling is at day-break especially in cloudy weather with a slight breeze, or when it is raining, snowing or hailing. When a storm is threatening the time is particularly favourable.

2. Fowling should always be carried on to the leeward or the wild ducks will be easily frightened away by scents and sounds.

3. In fowling the whole party must closely obey the leaders who take turn in watching the canals where fowling is carried on. After careful study from the ambush of the approaching birds in the canal he gives information by signals regarding the kind of ducks their number, etc. The fowlers in accordance with this draw the net and make other arrangements to prevent the escape of the birds.

5. Generally a fowling party is composed of six or eight men. They are divided into two groups termed "right" and "left" and are numbered according to their respective posts at which they attend to their nets. Falconers stand near to let their hawks catch ducks that may be flying away. The birds caught in nets are choked by one of party or by an assistant.

III. APPLIANCES OF FOWLING.

As mentioned before, fowling is in the main carried on by means of nets.

1. THE NET. This is similar to a butterfly net. The net is made of silk and is fixed on a bamboo frame about 5 ft. long. The method of using it is to draw it over the birds as they are swimming in the decoy canal.

2. SIGNALS. Signals are provided which put the accommodation house in direct communication with the small ambushes. The leader informs the fowlers of the movements of the birds by the means of signals.

IV. RULES TO BE OBSERVED IN THE PRESERVE.

1. All noises must be avoided in the Preserve. Near the Preserve, loud voices and noises are prohibited.
2. Only straw-sandals, and rubber shoes, are allowed as foot-wear.
3. All walking about shall be done outside the protective embankment as far as possible.
4. Intrusion to the watch stands is prohibited.
5. Bait must not be thrown into decoy-canals.
6. Nets must be carefully returned to the net houses.

Oct. 1902.

Board of Sports and Games.

IMPERIAL HOUSEHOLD DEPARTMENT.

The season for duck fowling begins in October and ends in April.

V. HAWKS.

Accipiter palumbarius L.

Several species of hawks are employed in fowling such as the Goshawk, the Perigrine falcon, and the Sparrow hawk. They are quite different from one another but we shall only consider the Goshawks which is the commonest species in use.

Both birds from Hokkaido and the northern districts of the Main Island are highly valued, while those from the vicinity of of Tokyo are called, "local" hawks and are not prized. The nature and habits depend much upon the breeding place. Young hawks under one year are called "kitaka" or yellow hawks, those under two years; "katatoki" or "half moulted;" under 3 years "morotoki" or "Full Moulded;" and under 4 years, "Third Mould" etc.

Those which were caught when able to get their own food are called "Amigake" (haggards); those which were taken from the nest and domesticated are called "Sutaka" (nest hawks).

Like other birds, once a year, between July and September, hawks moult from the wings to the tail. The plumage becomes more striking in appearance after several moultings. Young hawks just hatched are yellow, in the second year, they become nearer white in colour, gradually they become of a bluish gray colour attaining their permanent colour in their third or fourth year.

The males of Goshawks are called "Anitaka" (Tierceels). The male bird is somewhat smaller than the female, and is less valuable for sport. The females are termed "Aotaka" (Big Hawks) hawks built their eyries on a tree just under a well-out stretched branch. The eggs begin to hatch in June, the branch which shelters the nest is called "Manaita" (chopping board). The mother bird alights on this and drops into the nest her prey to feed the young. At first the prey consists of birds partly stunned, but as soon as the young get stronger, the prey is not much injured, and at last the young ones are led to get prey for themselves. When they are fully grown the mother bird takes the young high up into the sky and there parts from them.

Hawks, when first caught must be confined in a dark mew for one week, during which time only water is given them. When their appetite becomes very keen, the so-called "Yoizoye" or "evening training" is begun, succeeded by "Akezoze" or "morning training" and "Hiruzoye" or "day training."

"EVENING TRAINING." A falconer enters the mew at 8 o'clock in the evening. After having been deprived of food, the bird is more easily trained. On entering the mew, the falconer imitates the squeaks of a sparrow, showing a piece of pigeon's flesh, which the hungry bird is just ready to grasp. The falconer takes the bird at the same time on his hand from the perch. When it is quiet he walks around to accustom it to the sounds which he utters at intervals. When the bird has become used to this, it is taken outside and allowed to see moving objects until ten o'clock when it is again put in the mew. This is repeated every evening till the bird is accustomed to seeing strange people and hearing various noises. Finally it is taken into the streets of the town, and after it becomes used to all it sees and hears there it is ready for the next step in the training. During all these days only a little food is given each day, consisting of half the breast of a pigeon. The scant food makes it more easily tamed.

2. MORNING TRAINING. This training consists in taking the bird out from two o'clock until four o'clock in the morning every morning for about three weeks. The evening training is also continued, and the period of the morning exercises is gradually

prolonged until it extends to eight or ten o'clock. The bird is then ready for the day training.

3. **DAY TRAINING.** This training begins at about two o'clock in the afternoon in connection with the morning exercise. The bird is kept out till four o'clock when a little pigeon's flesh is given. In the evening training is carried on for an hour. Thus, the hours for training are, 4-8 and 10-12 a.m. 2-4 p.m. and 7-8 p.m. In the first and the third periods two sparrows are given for food. The giving of as little food as possible is the most important consideration in this system of training.

The regular ration for the morning and the evening consists of six or seven sparrows for each meal. When the hawk is quite strong, it is taken out to catch wild ducks and the quarry obtained is termed "First quarry."

4. **"CALLING."** In feeding the hawk from the "lure-box," the falconer shows the lure at a distance of 6 ft. which is gradually increased. This is termed "calling," as the falconer, calls the bird to the lure. This exercise continues for one week, calling from various distances and heights, so as to accustom the bird to return to the hand of the falconer when it fails to catch the game.

HAWKING. When a hawk is to be employed in the pursuit of wild ducks, it is held by a creance,—a long line attached to the leg, the other end of which is tied to the hand of a falconer. The falconer, who takes his post about 18 ft. from a decoy canal watches the fowling; and when the ducks fly up 24-30 ft. from the canal, he lets the hawk dart, choosing the best site from which to guide it. If the hawk is about to carry off the quarry, the falconer draws the line. Care must be taken in managing the bird as misjudgment on the part of the falconer often causes failure and the disheartening of the hawk.

When a hawk has caught a wild duck, the liver is immediately taken out, by cutting under one of the wings, and is given to the hawk. In the case of larks and other small birds, the brains are given to the hawk.

On the day of fowling, no other food is given to the hawk till the sport is over, but the bird is given rest on a perch. On other days she is trained from 1 to 3 p.m., and fed at 2 p.m.

MOULTING. As hawks moult the feathers from the end of July

to September, with the growth of the new ones, the so-called "jesses" should be removed from the leg. When the moulting ends "jesses" are again put on. For three weeks after this no food is given, and only a little water. By this fasting the bird is freed from the superfluous fat found around the entrails. Morning evering, and day training are practiced during this period.

VI. APPLIANCES FOR FOWLING.

1. The "Leash" (*Ohwo*) is a cord composed of eight silk threads terminating in a tassel at one end. Two "leashes" are attached to the leg. They are distinguished by their colours which are red or purple. The latter is the reward for a hawk which has beaten a crane.

2. The "Jess" (*Ashikawa*) is a strip of purple leather tied to the leg of a hawk, to which is fastened the end of a leash.

3. The "Under-jess" (*Igirikawa*) is also made of buckskin and is fastened to the leg of the hawk.

4. "Falconer's glove" (*Yugake*) is made of leather and is worn on the left hand of the falconer on which the hawk is carried.

5. The "Creance" (*Okinawa*) is a cord of raw-silk 210 ft. long, which serves to hold and direct the hawk in the pursuit of large game such as cranes, ducks, etc. A small piece of leather termed "toragawa" is attached to the end of the creance.

6. The "Sparrow sack," (*Suzume-fukuro*) is made of linen, and is taken by the falconer suspended from the belt. In it are carried living sparrows to be used in calling back the hawk when necessary.

7. The "Pigeon sack," (*Hoto-fukuro*) is of the same kind and is used to carry living pigeons. A pigeon is shown to the hawk when it fails to respond to the call of the falconer.

8. The "Prey basket" (*Kuchiye-kago*) is a basket, made of bamboo or rattan, in which dead birds are carried. These birds serve to quiet the hawk while it is perching on the hand of the falconer.

9. The "Water tube," (*Suizutsu*) is a section of a bamboo cane with knots at both ends. It is provided with a small mouth piece and is attached to the belt. It is used to provide water for the hawks.

10. The "Lure box," (*Egōshi*) is a lacquered box with a cover. It is suspended from the belt of the falconer.

11. The "Vervel," (*Suzu*) is a small bell attached to the tail of a hawk, by a "bell plate." It serves to trace missing hawks in bushes or grass.

12. The "Bell plate" (*Suzuita*) is a small piece of tortoise shell or, a jaw bone of a carp, fastened to the tail of a hawk, to strike against the "Vervel."

13. The "Falconer's pouch," (*Tsumebukuro*) is a leather sack for carrying requisites, such as knives and irons used in coping the hawk, etc.

14. The "Coping knife," is used for sharpening the beak and talons of a hawk.

15. The "Hot iron" is used for dressing spoiled feathers by giving them a gentle touch while it is hot.

16. The "Cauterizing Iron" are used to check bleeding which is often caused by coping.

17. The "Reamer" (*Kujiri*) is used to bore the slit of a "jess," and is made of horn or ivory.

18. The "Hawk perch," it is made of a plain white wood being $3\frac{1}{2}$ ft. long and supported by pieces 4 ft. high.

19. The "Linen brail," (*Fusekinu*) is a piece of a linen having a slit to pass over the pinions, hold the hawk firmly during the coping.

VII. WILD DUCKS.

Wild ducks in Japan are represented by more than 15 distinct species. They are birds of passage, coming generally to the preserve in September, while the summer months are passed in higher latitudes.

The stuffed specimens exhibited represent mostly birds which were caught during the season of 1902-1903. The eighteen specimens represent the following ten distinct species, and show the great beauty of the feathers.

1	<i>Anas crecca</i>	L.	♀ ♂
2	„ <i>baschas</i>	L.	♀ ♂
3	„ <i>clypeata</i>	L.	♀ ♂

4	„	Zonorhyncha Sw.	♀	♂
5	„	Formosa Georgi	♀	♂
6	„	falcata „	♀	♂
7	„	acuta L.	♀	♂
8	‘	Fuligula clangula L.	♀	♂
9		Anas penelope L.	♀	
10	„	galericulata L.	♀	

VIII. PHOTOGRAPHS OF THE IMPERIAL WILD DUCK PRESERVE
AT SHINHAMA.

1. General View of the Imperial Wild Ducks Preserve, Shin-hama.
2. Resting House.
3. General View of the compound.
4. "Small Ambush," and "Decoy Canal."
5. "Decoy Canal."
6. "Chief Ambush" or "Watch Stand."
7. Fowling Party waiting for the signal of the Leader at the "Small Ambush.
8. Party Ready for Fowling.
- 9-10. Catching Wild Ducks with Nets.



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